# Metals Review

VOLUME XXI •• No. 1 JANUARY 1948

## HEAT TREATING ISSUE

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*Featuring*

## Heat Treating During 1947

By Arthur R. Elsea
*Metallurgical Engineer*
*Battelle Memorial Institute*

Progress in fundamentals as reflected in the technical literature (with reference to source numbers in the Review of Current Literature).

## Products and Processes for Heat Treating

An index to new equipment developed or improved during the past 12 months.

## *NOTABLE LECTURES*

### Reported This Month

Donald S. Clark explains how an understanding of the physics of heat treating can dispel the so-called mysticism associated with the process . . . Raymond Grange says that the modern trend in the philosophy of heat treatment is toward greater consideration for field service requirements rather than chemistry . . . The structure of metals will be more important than their composition, Cyril Smith predicts, and the future of metallurgy lies in physics rather than chemistry . . . H. J. Babcock and A. F. Holden expound the advantages of salt baths at Muncie and Northwestern Pennsylvania Chapters, respectively . . . Walter Schlegel and Harry Crump debate the uses and characteristics of high speed vs. carbide tools.

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# Metals Review

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**Vol. XXI, No. 1** **January 1948**

**RAY T. BAYLESS, Publishing Director** **MARJORIE R. HYSLOP, Editor** **GEORGE H. LOUGHNER, Production Manager**

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# *Heat Treating During 1947*

## Progress in Fundamentals as Reflected in the Current Literature

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by Arthur R. Elsea

*Metallurgical Engineer, Battelle Memorial Institute*

HEAT TREATMENT—the process of altering the mechanical properties and internal structure of metals by controlled heating and cooling—has been practiced for several thousand years. Early in its history, this process was strictly an art, surrounded by superstition. Later, when "rules of thumb" were learned, heat treating knowledge was closely guarded as a trade secret. It is interesting to contrast this shroud of secrecy and its accompanying slow rate of progress with our present-day open discussions of technical knowledge and the resulting rapid engineering advances.

The tendency in modern engineering design to take full advantage of the inherent properties of metals not only reflects a greater knowledge of the mechanical properties required for each application, but also gives mute testimony to the improved quality and uniformity of metal products. The urge for weight reduction, especially in the field of transportation, calls for the use of lightweight, heat treated alloy steel parts to take the place of unalloyed, untreated steel castings and forgings formerly used. Improvements in heat treating practice which have resulted in a more uniform product at a reduced cost make such substitutions economically feasible and also practical from the standpoint of the design engineer.

### Homogenization

Past practice has been to homogenize steel castings at very high temperatures for long periods of time so as to eliminate the alloy and carbon segregation which occurs during solidification, and thus partially to destroy the cast structure before further heat treatment. Such homogenization treatments were costly but were felt to be justified by the probable improvement in the mechanical properties of the casting.

Kura and Rosenthal (18-265, 1946 Volume)* conducted an investigation to determine the effects of homogenizing heat treatment, ranging from 2 hr. at 1650° F. to 12 hr. at 2250° F., on the hardenability and mechanical properties of five commercially cast low-alloy steel plates. They found that any deviations in the characteristics of the steels were more closely related to the position within the original cast plate than to the homogenization treatment, which produced no appreciable change in the properties of hardened and tempered specimens.

These results were substantiated by Marcotte and Eddy (18-176, Sept. 1947), who conclude that homogenization treatments, employing high or normal heat treating temperatures for long periods of time, do not improve the mechanical properties and hardenability of cast steels sufficiently to be justified. Thus, it would seem that the costly homogenization treatments used on low and medium-alloy cast steels could be replaced by a relatively low-cost normalizing treatment.

### Austenite Decomposition

Since Davenport and Bain published their work on "Transformation of Austenite at Constant Subcritical Temperature" many investigators have used their technique to study austenite decomposition. Each year additional TTT-diagrams are published and are now available for most of the commonly used structural, automotive, and toolsteels.

During the past year Troiano and DeMoss (4-103, Sept. 1947) investigated the transformation characteristics of a low-carbon and high-carbon (representing the core and case, respectively) Krupp-type carburizing steel. Because of the difficulties encountered in trying to determine $Ac_M$ in the high-carbon steel, a new technique was developed in which X-ray diffraction measurements of the axial ratio of martensite were employed.

Hawkes and Mehl (4-147, Nov. 1947) have found that cobalt as an alloying element in steel increases the rate of austenite decomposition at all temperatures between $Ae_1$ and Ar", but that there is no change in the shape of the S-curve or in the nature of the austenite decomposition products. Cobalt decreases pearlite hardenability by decreasing both the rate of nucleation and the rate of growth. Cobalt also raises the temperature range for martensite formation.

The isothermal transformation characteristics of Type 135 nitralloy were determined by Grange, Holt, and Tkac (4-135, 1946 Volume). The TTT-diagram for this steel resembles that of certain other low-alloy steels such as S.A.E. 4340. Corresponding data were not available for a steel of similar composition without aluminum, but it was concluded that the 1.25% aluminum present in Type 135 nitralloy raised the Ms, $Ae_1$, and $Ac_3$ temperatures, but had no appreciable effect upon hardenability.

Those interested in the basic principles of austenite decomposition will do well to study the recent paper by Hultgren (4-109, 1946 Volume). He investigated the isothermal transformation characteristics of 19 steels, most of which were alloyed with either manganese or tungsten. His results are in agreement with the suggestions of earlier investigators that pearlite is nucleated by carbide while bainite is nucleated by ferrite, both being formed as aggregates of ferrite and carbide.

Considerable uncertainty still exists regarding the martensite and bainite reactions at the lower part of the TTT-diagrams. The structure of low-temperature bainite (as seen in the metallurgical microscope) is indistinguishable from that of martensite formed at the higher temperatures in its transformation range. Despite this similarity, tempered bainite is considered to be inferior to tempered martensite from the standpoint of mechanical properties (4-111, 1946 Volume). Howard and Cohen (4-161, Nov. 1947) have conducted tests on five steels using the Greninger-Troiano technique to study the austenite-to-martensite reaction, and conventional isothermal treatments both above and below the Ms temperature to study the bainite reaction. Their results indicate that isothermal transformation of austenite into bainite occurs both above and below the Ms temperature, with an incubation or nucleation period in both cases. In general, the rate of bainite formation decreases with decreasing temperature in the range investigated, except just below the Ms temperature where the presence of martensite hastens nucleation of the isothermal reaction. The low-temperature part of the austenite transformation diagram is a blending of the martensite and bainite regions.

A unique method of studying the austenite-to-martensite transformation is reported by McReynolds (11-93, 1946 Volume). Small wire samples were heated and cooled either in vacuo or in air while temperature and electrical resistance were automatically recorded. From these data a complete record of the transformation during cooling was

*(Turn to page 7)*

*Literature references are designated by the corresponding item number in the Review of Current Metal Literature rather than by repeating the entire title, author and source; the reader can get this information by referring to *Metals Review* for the month indicated or to the bound volume for 1946.

# A.S.M. Review of Current Metal Literature

An Annotated Survey of Engineering, Scientific and Industrial Journals and Books Here and Abroad, Received in the Library of Battelle Memorial Institute, Columbus, Ohio, During the Past Month.

## 1 ORES & RAW MATERIALS Production; Beneficiation

**1-152. Presidential Address: Modern Metallurgical Practice on the Witwatersand.** A. Clemes. *Journal of the Chemical, Metallurgical and Mining Society of South Africa*, v. 48, Aug. 1947, p. 44-58; discussion, p. 58-64.

Review of methods used.

**1-153. The Treatment of Gold Ore Containing Pyrrhotite at the Sub Nigel, Ltd.** D. L. Carson. *Journal of the Chemical, Metallurgical and Mining Society of South Africa*, v. 48, Aug. 1947, p. 64-66.

Effect of pyrrhotite in the ore at Marievale Consolidated Mines, Ltd., compared with information given by A. King, A. Clemes and H. E. Cross in their paper (Feb. issue).

**1-154. The Yellow Pine Mill.** *Mining World*, v. 9, Nov. 1947, p. 26-31.

Mining and beneficiation of antimony-gold ore. Stibnite recovered by flotation.

**1-155. Treatment at the Bibiani Gold Mine, West Africa.** H. A. McGowan. *Bulletin of the Institution of Mining and Metallurgy*, Nov. 1947, p. 1-24.

Details of treatment; flow sheets and procedures.

**1-156. Developments of Carbon Cyanidation at Getchell Mine, Nevada.** Royce A. Hardy and F. W. McQuiston, Jr. *Mining Congress Journal*, v. 33, Nov. 1947, p. 42-43.

The carbon cyanide treatment of complex gold ores has considerable merit when treating ores presenting thickening and filtering problems.

**1-157. Notes on Drying for Electrostatic Separation of Particles.** Foster Fraas. *Mining Technology*, v. 11, Nov. 1947, T.P. 2257, 14 p.

The electrostatic separation of broken solids by use of differences in conductance, differences in contact potential, frictional electricity, or in dielectric constant; effects of the presence of moisture or other liquid in various proportions. Water present in volumes greater than permissible can be removed mechanically (by centrifuge) or by evaporation. Recovery of the dielectric liquid medium in the dielectric-constant method of separation. 23 ref.

**1-158. Effect of "Metso" (Sodium Metasilicate) on Mill Recoveries of Alta-St. Louis Ores.** Henry P. Ehrlinger. *Mining Technology*, v. 11, Nov. 1947, T.P. 2272, 3 p.

Particles of gold and galena were badly coated with slime after grinding. Addition of metasilicate resulted in defloculation of the slime in the pulp and in cleaning of the surfaces of the mineral particles so they were more amenable to flotation. Sodium silicate did not improve the results to any extent.

**1-159. Factors Which Control Liquation in Metallurgy.** E. A. Peretti. *Engineering and Mining Journal*, v. 148, Dec. 1947, p. 76-78.

In extractive metallurgy, liquation is the process of separating a fusible substance from one less fusible by melting one or more of the constituents. Fundamentals of this process and the effects of various factors such as relative size of the different particles involved and viscosity of the different phases.

**For additional annotations indexed in other sections, see: 26-196.**

## 2 SMELTING AND REFINING

**2-271. The Mechanism of the Carbon-Oxygen Reaction in Steelmaking.** C. E. Sims. *Electric Furnace Steel Conference Proceedings*, v. 4, 1947, p. 15-28; discussion, p. 28-30.

See item 2-16.

**2-272. Oxygen in Basic Electric-Furnace Baths.** S. F. Urban and G. Derge. *Electric Furnace Steel Conference Proceedings*, v. 4, 1947, p. 31-45; discussion, p. 45-49.

See item 2-139.

**2-273. The Origin of Silicate Inclusions in Basic Electric-Arc Furnace Steel of Higher Carbon Contents.** Axel Hultgren. *Electric Furnace Steel Conference Proceedings*, v. 4, 1947, p. 50-77; discussion, p. 77-80.

Two types of steel made in a basic-lined arc furnace were investigated (a 1.10% C steel and a 0.65% C, 0.70% Si, 1.0% Mn, spring steel). Conditions for formation of silicate inclusions, effect of period in ladle, and value of different means for reducing amount of inclusions. 20 ref. (Translated from *Jernkontorets Annaler*, v. 129, no. 11, 1945, p. 633.)

**2-274. Preparation of Raw Materials for Fast Melting in an Electric-Arc Furnace.** Samuel D. Gladding. *Electric Furnace Steel Conference Proceedings*, v. 4, 1947, p. 81-87.

Automatic control; transformers; methods of charging; charging scrap; scrap preparation; drying raw materials; meltdown of oxidizers and fluxes. (Reprinted from Yearbook of the American Iron and Steel Institute, 1946, p. 94.)

**2-275. The Oxidizing Period in Basic Electric Steelmaking.** Alex C. Texter. *Electric Furnace Steel Conference Proceedings*, v. 4, 1947, p. 87-96; discussion, p. 96-104.

Three distinct methods of oxidation; control of the furnace charge; functions of the oxidizing slag, and the boiling and reboiling periods. Standard practices for 35-ton furnaces.

**2-276. Melting Semikilled Steel in the Basic Electric Furnace.** R. J. McCurdy and R. W. Farley. *Electric Furnace Steel Conference Proceedings*, v. 4, 1947, p. 105-107; discussion, p. 113-122.

Charging for fast melting: tapping without blocking, with all additions to the ladle; pouring in open-top molds.

**2-277. Production of Rimmed Steel in the Basic Electric Furnace.** A. K. Moore. *Electric Furnace Steel Conference Proceedings*, v. 4, 1947, p. 107-109; discussion, p. 113-122.

Practice at the Steel Co. of Canada, Hamilton.

**2-278. Steelmaking Operation at Connors Steel Co.** B. C. Blake. *Electric Furnace Steel Conference Proceedings*, v. 4, 1947, p. 110-111; discussion, p. 113-122.

Steelmaking facilities comprise two top-charge Lectromelt furnaces; one a 4½-ton, and the other a 3-ton. Both are lined for basic operation.

**2-279. Practice by Burlington Steel Co., Ltd.** G. H. McCally. *Electric Furnace Steel Conference Proceedings*, v. 4, 1947, p. 112-113; discussion, p. 113-122.

Electric-furnace production of straight-carbon merchant bar.

**2-280. Melting Stainless Steel at South Works.** J. H. Eisaman. *Electric Furnace Steel Conference Proceedings*, v. 4, 1947, p. 123-127; discussion, p. 127-129.

Procedures using Heroult 3-phase, type-70 arc furnaces, tapping 80-ton heats.

**2-281. Use of Inert Gas.** P. M. Hulme. *Electric Furnace Steel Conference Proceedings*, v. 4, 1947, p. 137-140.

Use of argon and nitrogen to remove dissolved gas from molten steel. Methods of determining the gas content of molten metals.

**2-282. Progress in the Use of Argon Gas.** W. M. Farnsworth. *Electric Furnace Steel Conference Proceedings*, v. 4, 1947, p. 140-143.

Experience at Canton Alloy Plant of Republic Steel Corp.

**2-283. Mechanism of Hydrogen Elimination From Fluid Steel.** A. L. Ascik. *Electric Furnace Steel Conference Proceedings*, v. 4, 1947, p. 143-145.

**2-284. Melting of High Speed Steel in the Electric-Arc Furnace.** R. Schempp and J. B. Schrader. *Electric Furnace Steel Conference Proceedings*, v. 4, 1947, p. 146-154; discussion, p. 154-159.

Furnace equipment and accessories and their condition; make-up of the charge, from both physical and chemical viewpoints; types of alloy materials; slagmaking materials; particular phases of melting practice, such as meltdown and refining periods and specific temperature control, as well as tapping and teeming temperatures.

**2-285. Arc Versus Induction Furnace Melting.** S. F. Urban. *Electric Furnace Steel Conference Proceedings*, v. 4, 1947, p. 159-161; discussion, p. 161.

**2-286. Notes on Melting Heat and Corrosion Resistant Metals by the Acid Electric Process.** Floyd O. Lemmon. *Electric Furnace Steel Conference Proceedings*, v. 4, 1947, p. 163-166; discussion, p. 166-170.

**2-287. Induction Melting of High-Alloy Steels.** R. J. Wilcox. *Electric Furnace Steel Conference Proceedings*, v. 4, 1947, p. 170-175; discussion, p. 175-184.

Furnace linings, melting practice, and control testing. Operating data.

**2-288. Acid Electric Slags.** G. R. Fitterer. *Electric Furnace Steel Conference Proceedings*, v. 4, 1947, p. 185-196; discussion, p. 196-198.

The slag-fluidity test. Fundamental principles controlling reactions in acid furnaces. Experimental results.

**2-289. Acid Electric Slags Are a Necessary Evil.** E. C. Troy. *Electric Furnace Steel Conference Proceedings*, v. 4, 1947, p. 199-203; discussion, p. 204.

The nomenclature and classification of slags. The need for slag to control degree of oxidation; suggestions for its control.

**2-290. You're Stuck With Slag—Why Not Use It?** J. B. Caine. *Electric Furnace Steel Conference Proceedings*, v. 4, 1947, p. 204-209; discussion, p. 209-218.

A plot of partition constant for oxygen, or iron oxide, between metal and acid slag vs. temperature is independent of the analysis of either slag or metal. This is contrary to accepted

*(Turn to page 8)*

computed. This method is useful in studying steels which react too rapidly to be handled by the Greninger-Troiano method.

Digges and Reinhart (3-273, Oct. 1947) have found that the presence of boron in steel has no significant influence on the cleanliness, hot working properties, transformation temperatures, tempering, weldability, or tensile properties. Hardenability is improved by boron additions, but no correlation exists between the increase in hardenability and the amount of boron added or retained by the steel. Thus, the magnitude of the effect of boron on hardenability seems to depend upon its mode of existence in austenite rather than upon the amount. Hardenability of steels with high soluble nitrogen increases but little when boron is added; however, the boron effect can be obtained by fixing the nitrogen as certain nitrides.

Although TTT-diagrams afford a convenient method of comparing the transformation characteristics of one steel with those of another, or of comparing the effects of various alloy additions, the data obtained from such diagrams cannot be applied directly to the heat treatment of steel by merely superimposing a cooling curve upon the TTT-diagram. To circumvent this difficulty, Liedholm has conducted numerous investigations on the transformation of austenite during continuous cooling. His most recent work (4-108, 1946 Volume) shows the effects of transformation during continuous cooling upon subsequent isothermal reactions in hypo-eutectoid steels possessing high pearlite and high bainite hardenabilities. These data show that ferrite rejected during continuous cooling may cause a considerable increase in the time required to complete isothermal transformation in the bainite region. This is to be expected, of course, since carbon enrichment of austenite, resulting from the rejection of ferrite, would greatly increase the bainite hardenability of the steel.

Continuous cooling transformation diagrams may sometimes be applied almost directly to quenching treatments. Caution must be exercised, however, when dealing with heavy steel sections, since Manning (18-226, 1946 Volume) has shown that the mass of the specimen has an effect on transformation that goes beyond the well-known effect of mass on cooling rate. He suggests that thermal and transformation stresses set up during the quench may influence transformation—tensile stresses promoting and compressive stresses inhibiting the decomposition of austenite. In sections less than 2 in. thick, the stresses apparently are too small to be noticeable, but their effect becomes quite apparent in sections over 2 in. thick.

Hollomon, Jaffe, McCarthy, and Norton (4-111, 1946 Volume) have shown that tempered martensite possesses the optimum combination of mechanical properties attainable in heat treated steel. Thus, from one point of view, knowledge of the transformation which occurs above the Ms temperature during the quench is important only insofar as it may help in the prevention of such transformation. (It is directly applicable to problems of normalizing and annealing.)

*Arthur R. Elsea is a metallurgical engineer on the research staff of Battelle Institute. He is a graduate of Ohio State University and has been associated with the Institute since 1939. He has engaged in numerous studies and written papers on the effects of composition, heat treatment, and mechanical work on the structure and properties of metals.*

One of the problems most frequently encountered in attempting to produce a fully martensitic structure is insufficient hardenability in the steel to form martensite at the center of the section, even with the most severe quench. Nothing can be done to remedy this except increase the hardenability of the steel by adding carbon, alloys, or both. If the section to be hardened is less than 2 in. thick, positions with equal cooling rates in the end-quench hardenability specimen and in the section being hardened will have about equal hardness values, and it is a simple matter to determine whether the center of the section will be fully hardened. On the other hand, if the section is over 2 in. thick, positions in the end-quench specimen and in the section being heat treated, with equivalent cooling rates, may have quite different hardness values. However, Rosenthal and Manning (18-251, 1946 Volume) have shown that if the hardenability of the steel is high enough to maintain practically full hardening throughout the length of the standard end-quench bar, then it is also sufficiently high, for all practical purposes, to fully harden sections with cooling rates as low as 1° F. per sec.

A recent data sheet prepared by Boegehold (18-18, Feb. 1947) shows revised average cooling rates at various positions in end-quench hardenability specimens made of 1045, 9420, and 9445 steel, compared with the cooling rate values given on the S.A.E. standard chart. Cooling rates near the end of the hardenability specimen are considerably faster than indicated in the S.A.E. standards.

Those who work with shallow hardening steels will welcome the announcement by Shepherd (9-96, Sept. 1947) of a new hardenability test designed specifically for steels which require cooling rates faster than 80° F. per sec. at 1300° F., for the structure to consist of 50% martensite. Called the P-V test, symbolizing Penetration-Velocity, it has the advantage of greatly extending the region of rapid cooling found only very near the quenched end of the end-quench specimen.

The P-V specimen has a 90° chisel edge and is 1⅛ in. long. It is made with only two cuts diagonally across the bar (1½ in. diameter) at 45° to the longitudinal axis. A third cut at 90° to the axis of the bar and 1⅛ in. from the chisel edge completes the specimen. Specimens are austenized and then quenched in a special fixture which directs a stream of brine or water against the chisel edge, one half of the stream flowing along each chisel face. A slice ⅜ in. thick is cut from the center of the specimen at 90° to the chisel edge. A hardness traverse is then run along the line bisecting the 90° angle between the chisel faces. From a plot of these data, the distance from the chisel edge to the position with a hardness representing 50% martensite is determined, and this distance, in inches, is known as the P-V number. Using 50% martensite as the criterion may be excusable in shallow hardening steels, although it is entirely illogical as the basic criterion in deep hardening steels.

Advantages of the P-V test are simplicity and the low cost of machining the specimen. A disadvantage (also inherent in the Post and Greene cone test) is that the actual hardenability determination is made on the material at the core of the bar where, in shallow hardening steels, one is seldom concerned with the hardenability. Of course, the specimen could be machined off-center from a large bar but this would increase the cost considerably.

The P-V test cannot be expected to have the sensitivity to slight changes in hardenability shown by the Post and Greene cone test, since the latter extends the hardened zone over a greater distance. On the other hand, great care must be exercised in sectioning the Post and Greene cone specimen after hardening, since if it is slightly off-center the hardenability value will be considerably affected. This adds to the cost of the test.

The P-V test has sufficient sensitivity and is sufficiently foolproof for classifying shallow hardening steels commercially. The greater sensitivity of the Post and Greene cone test makes it somewhat more desirable for use in fundamental investigations.

The problem of obtaining a fully martensitic structure is not solved merely by selecting a steel with suffi-

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thought (that oxygen content is mainly dependent on carbon content) but offers the possibility of producing steel free from pinhole porosity when poured in green sand, without use of strong deoxidizers, by use of a slag low in iron oxide to lower the oxygen content of the metal. The problem of inclusions in wrought steel and cast steel.

**2-291. Known Methods of Sulphur Control.** M. V. Healey. *Electric Furnace Steel Conference Proceedings*, v. 4, 1947, p. 233-235; discussion, p. 235.

Procedures for sulphur elimination in basic electric melting at General Electric.

**2-292. The Perrin Process.** Jerome Strauss. *Electric Furnace Steel Conference Proceedings*, v. 4, 1947, p. 236-238; discussion, p. 238-240.

Essentially the Perrin process consists of violent intermixing of steel and a predetermined slag for sulphur neutralization carried out to the point of emulsification. A siliceous slag, very low in iron, was initially used. An aluminous slag has since been adopted. One-half to two-thirds reduction in sulphur content is claimed.

**2-293. Desulphurized Steel Made by the Triplex Process.** Harold DeMent. *Electric Furnace Steel Conference Proceedings*, v. 4, 1947, p. 241-243; discussion, p. 243-245.

Use of soda-ash briquettes to produce a steel with a sulphur content below 0.050% from a low grade of steel scrap.

**2-294. Possibilities of Use of Spodumene for Removal of Sulphur.** G. T. Motock. *Electric Furnace Steel Conference Proceedings*, v. 4, 1947, p. 245-246; discussion, p. 246-248.

Use of this lithium aluminum silicate for sulphur removal in both acid and basic steelmaking. Results show a marked increase in fluidity of both steel and slag and a removal of about 55% of the sulphur in the steel and about 45% of that in the slag.

**2-295. Solidification of Steel Ingots.** J. R. Fleche. *Iron Age*, v. 160, Oct. 9, 1947, p. 62-67; Oct. 23, 1947, p. 55-62.

Attacking the subject mathematically, in order to lead to a better understanding of the functioning of ingot molds, the author develops his analyses around K, a comparative measure of the linear freezing speed. In the first part of a four-part article, fundamental concepts regarding solidification are introduced, and methods whereby K values can be utilized are presented. In the second part, some requirements of mold design are discussed. Corrections to K values, to permit comparison with other types of steels and other types of ingots, and relative effects on speed of freezing of various mold shapes.

**2-296. A Carbothermic Process for Production of Magnesium.** H. A. Doerner. *Western Metals*, v. 5, Nov. 1947, p. 15-20.

Information from Bureau of Mines Reports of Investigations 3635, 3806, 3823, and papers presented orally by H. A. Doerner.

**2-297. Oxygen-Accelerated Combustion in Openhearth Furnaces.** E. T. W. Bailey. *Iron and Steel Engineer*, v. 24, Nov. 1947, p. 35-41.

The dual use of oxygen for accelerating combustion and burning elements in the bath. Charts for calculation of combustion conditions; photographs of actual flames.

**2-298. A Measure of Dispersion of Carbide Spheroids.** N. T. Belaiew. *Metal Progress*, v. 52, Nov. 1947, p. 827.

New scheme and chart for the numerical characterization of spheroidite.

**2-299. Side-Blown Converter Producing Carbon and Alloy Steels.** F. Cousans. *American Foundryman*, v. 12, Nov. 1947, p. 30-34.

Exchange paper from Institute of British Foundrymen (see item 2-195).

**2-300. The Effect of Nozzle Size on the Surface Quality of Slab Product of Low-Carbon Rimmed Steel.** Condensed from paper by C. J. Hunter. *Industrial Heating*, v. 14, Nov. 1947, p. 1860, 1862.

Results of experiments on rimmed, mechanically capped, and semikilled low-carbon steels. (Presented at recent National Open Hearth Steel Conference, Cincinnati, Ohio.)

**2-301. Basic Openhearth Slag Control. Part IV.** Charles R. Funk. *Blast Furnace and Steel Plant*, v. 35, Nov. 1947, p. 1372-1374.

Charts and data concerning manganese recovery. (To be continued.)

**2-302. Electrical Equipment of Aluminum Factory.** *Engineering*, v. 164, Nov. 7, 1947, p. 440.

Equipment at the South Wales Aluminum Co., Ltd., Resolven, Glamorgan.

**2-303. Experimental Steel Production With Oxygen-Enriched Blast in Bessemer Converter at Kuznetsk Steel Works.** V. V. Konjakov. *Engineers' Digest (American Edition)*, v. 4, Nov. 1947, p. 522-523.

Details of performance and converter construction. (Translated and condensed from *Kislorod*, v. 3, 1946, p. 1-11.)

**2-304. Purification of Zirconium by Ion Exchange Columns.** John A. Ayres. *Journal of the American Chemical Society*, v. 69, Nov. 1947, p. 2879-2881.

Method is rapid and easily adaptable to large scale procedures. Results of several experiments show the efficiency of purification of zirconium from iron, titanium, beryllium, and lanthanum.

**2-305. The Use of Gaseous Oxygen in Metallurgical Processes.** George V. Slottman and P. M. Hulme. *Metal Progress*, v. 52, Dec. 1947, p. 963-967.

Developments of past year resulting from the first large-scale use in the openhearth in the U. S. Limiting factors in openhearth practice; control of hot metal; use during meltdown; use in working, and finishing the heat.

**2-306. Fluidization in Noncatalytic Operations.** R. P. Kite and E. J. Roberts. *Chemical Engineering*, v. 54, Dec. 1947, p. 112-115.

Application of the process, which has been so successful in the refinery, to miscellaneous noncatalytic operations, including roasting of concentrates and lime burning.

**2-307. Furnace Deoxidation in Basic Openhearth Practice.** *Industrial Heating*, v. 14, Dec. 1947, p. 2020, 2022, 2024, 2026.

Discusses the factors to be considered when engaging in the deoxidation of a basic openhearth furnace. (Condensed from paper by W. O. Philbrook, presented at 30th Annual Open-Hearth Conference, Cincinnati.)

**2-308. Electric Furnace Steelmen Study Quality Problems.** *Iron Age*, v. 160, Dec. 11, 1947, p. 105-107.

Reviews proceedings of Fifth Annual A.I.M.E. Electric Furnace Steel Conference.

**2-309. Electric Furnace Operators Evaluate Steel Cleanliness.** *Steel*, v. 121, Dec. 22, 1947, p. 74, 76, 78, 80.

Reviews proceedings of Fifth Annual Electric Furnace Steel Conference sponsored by the Electric Furnace Steel Committee of the Iron and Steel Division, A.I.M.E., Pittsburgh, Dec. 4-6, 1947. Among topics covered were: trend in electric-furnace shops towards use of lime-silica or slightly carbidic slag during refining period; source of refractory inclusions; Dornin process for high ingot yield; and oxygen practice.

**For additional annotations indexed in other sections, see:**
**7**-479; **14**-363; **15**-47; **16**-157-158; **26**-189; **27**-281.

## 3 PROPERTIES OF METALS AND ALLOYS

**3-380. Effect of Sulphur in Cast Steel.** G. A. Lillieqvist. *Electric Furnace Steel Conference Proceedings*, v. 4, 1947, p. 219-230; discussion, p. 230-233.

Results of experiments on aluminum-killed steels. When the aluminum addition is sufficiently large, a double sulphide of aluminum and iron appears in the form of inclusions which result in maximum ductility. Effects of sulphur and aluminum on yield and tensile strengths, ductility, and impact strength, and on hot-tear formation; spiral fluidity tests on sulphur-containing melts. 11 ref.

**3-381. The Change in Mechanical Properties of Mild Steel Under Repeated Impact.** F. V. Warnock and J. A. Pope. *Institution of Mechanical Engineers Proceedings*, v. 157, War Emergency Issue No. 26, 1947, p. 33-44; discussion, p. 45-51.

Results of experiments in which a falling-tup type of tensile impact machine was used. A scratch extensometer was fitted to the specimen, and the stresses induced were investigated. Mean stress per blow is calculated for various velocities of impact and energy per blow. Observed phenomena and their practical significance.

**3-382. Erosive Effects of Gun Blast on Materials—Development of a Strong Brittle Alloy.** James A. Broadston. *ASTM Bulletin*, Oct. 1947, p. 39-46.

Adoption of jet propulsion for piloted aircraft has made it necessary to reduce drag to a minimum. Gunport doors arranged to open and close before and after each firing are necessary. Many metallic and nonmetallic materials were evaluated for these doors, and a strong and brittle Cu-Mg-Zn aluminum alloy was developed. Results of mechanical testing and metallographic inspection of this alloy; the gun-blast deposit and of its corrosive effect upon the alloy. (Presented at Annual Meeting, A.S.T.M., Atlantic City, N. J.)

**3-383. Pearlitic Malleable Cast Iron.** *Engineering Materials and Processes*, v. 5, Oct. 1947, p. 138-141.

Properties and applications.

**3-384. Creep and Some Creep Resisting Alloys.** G. Burns. *Engineering Materials and Processes*, v. 5, Oct. 1947, p. 123-126.

**3-385. Strain-Age Embrittlement of Steel.** *Engineer*, v. 184, Oct. 31, 1947, p. 412-413.

Reviews critically six recent papers on this subject.

**3-386. Cast Iron and Steel; Influence and Commercial Applications of Constituent Elements. (Concluded.)** Ernest C. Pigott. *Iron and Steel*, v. 20, Nov. 1947, p. 519-520.

Tungsten, uranium, vanadium, zinc, and zirconium.

**3-387. Mechanism of Fracture of Glass and Similar Brittle Solids.** Nelson W. Taylor. *Journal of Applied Physics*, v. 18, Nov. 1947, p. 943-955.

A theory is proposed which connects stress required to break a brittle material in simple tension with duration of application. Applicability to fatigue of metals under stress-corrosion conditions. An equation is proposed which connects Young's modulus and the critical fracture distance with the surface tension of the solid. 28 ref. (Presented at Annual Meeting, Society of Rheology, New York, Nov. 2, 1946.)

**3-388. Mechanical Behavior of High Damping Metals.** Clarence Zener. *Journal of Applied Physics*, v. 18, Nov. 1947, p. 1022-1025.

The relation between the two meas-

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cient hardenability to produce martensite throughout the section in question. Steels with high hardenabilities may be subject to quench cracking, or the presence of retained austenite may cause parts to fail through dimensional instability and excessive brittleness when the retained austenite transforms to martensite.

Kappel (4-47, May 1947), investigating the cause of airplane accidents, found that 12% were the result of part failures. Aircraft fittings, bolts and parts, which are subjected to very high stresses in service, are heat treated to close hardness specifications so as to have the maximum ductility commensurate with the required strength. Quenching cracks are a big problem and many such parts are removed from the oil quench while they are still quite hot and transferred to a tempering furnace. After tempering they are carefully inspected, using magnaflux and hardness tests, and are found to be within the specified hardness range.

On several occasions failed aircraft parts were found to be considerably harder than the specifications called for. After subzero treatments hardness increased still further. This would indicate that retained austenite, present after tempering, transformed to martensite at the low temperatures encountered at high altitudes and the resulting embrittlement caused failure of the part.

Studies on cast steels by Udy and Barnett (18-157, Sept. 1947) show that high hardenability is not, of itself, responsible for quench cracking. Rather it is caused by the lowering of the martensite transformation temperature by most of the alloys added to improve hardenability. Heat treating variables which tend to lower the Ms temperature will also tend to promote quench cracking, although composition is the most potent factor. Carbon, manganese, chromium, and phosphorus are the strongest promoters of cracking, with carbon being by far the worst. Sulphur, silicon, nickel, molybdenum, and aluminum have little, if any, effect. Udy and Barnett developed a test to determine the susceptibility of a given steel to quench cracking that should prove quite useful.

Martempering has been used to eliminate quench cracks. The process consists of quenching the piece in a molten salt bath or some other suitable medium to just above the Ms temperature, holding until temperature gradients in the piece have been removed, and then cooling very slowly through the martensite transformation range. The piece should be fully austenitic after the temperature gradients have been equalized and, upon slowly cooling through the martensite transformation range, martensite will form uniformly throughout the section, thus eliminating the severe thermal and transformation stresses that cause cracking.

Martempering is useful for some applications, but has definite limitations. Cost of equipment which could handle large sections would be prohibitive. In many steels transformation to ferrite, pearlite, or bainite would occur during the quenching and equalizing interval. The process finds its greatest field of application in heat treating relatively small parts made of highly alloyed steels with sluggish reactions. Most of the oil hardening steels are suitable provided the sections are not too thick.

Boyer (18-239, 1946 Volume) has found that low and medium-carbon alloy steels of the oil hardening type may be martempered successfully, but under certain conditions the high-carbon oil hardening steels (such as S.A.E. 52100) may be more susceptible to cracking when martempered than when oil quenched from the austenizing temperature. The relative amounts of austenite retained after oil quenching and after martempering from a series of austenizing temperatures were determined for S.A.E. 52100. Austenizing temperatures up to 1550° F. resulted in about the same amount of retained austenite with both treatments; higher austenizing temperatures did not change the amount of retained austenite in the martempered steel, but caused a drastic increase in the amount observed in the oil quenched steel. Boyer concluded that the increased amount of retained austenite present after oil quenching from high austenizing temperatures has a cushioning effect upon the stresses set up during martensite formation.

High-carbon tool and die steels retain austenite to a greater degree than the lower carbon structural and automotive steels because the high-carbon austenite transforms to martensite at a much lower temperature. The Mf temperature for many of these steels is considerably lower than room temperature, and a subzero treatment may cause all or part of the residual austenite to transform to martensite.

In two articles (18-101, July 1947, and 18-115, Aug. 1947) Cohen gives the results of an extensive investigation on the tempering of toolsteel. High speed steel (18-4-1) austenized at 2350° F. starts to form martensite at about 450° F. and if the steel is cooled without interruption to subzero temperatures, almost all of the austenite will transform to martensite. However, if the quench is interrupted at room temperature, the steel will contain approximately 20% austenite. Although austenite is considered to be a tough, ductile phase, it is not a desirable constituent in toolsteel. Under the stresses set up in service, this austenite would transform to martensite, embrittling the steel. If retained austenite were present in the steel from which precision gages are made, transformation of only 0.75% austenite will result in an expansion of 0.0001 in. per in., and the accuracy of the gages would be destroyed.

If a toolsteel contains martensite and retained austenite after the quench, then tempering at 400 to 600° F. will decompose the martensite into ferrite and a transition precipitate, transform the retained austenite, form cementite from the products of the first two reactions, and finally convert the cementite into more stable carbides, when strong carbide-forming elements are present. In highly alloyed toolsteels, the retained austenite is very sluggish and will not transform in the 400 to 600° F. range, although cooling from about 1050° F. to room temperature will result in partial transformation of the austenite to martensite. Double or triple tempering will form structures consisting almost entirely of tempered martensite.

Since subzero treatments will transform a major portion of the retained austenite to martensite, it would seem logical to use this process rather than the double or triple tempering outlined by Cohen. However, Jackson (18-14, Feb. 1947) found that subzero treatments often cause microcracks in high speed and high-alloy steels, and that these microcracks lead to early fatigue failure. He believes that insufficient practical work has been carried out to substantiate claims that life of toolsteels is improved by subzero treatment. Low-temperature treatments should be considered for applications requiring dimensional stability and high hardness values.

Isothermal transformation of high speed steels in the temperature range of 450 to 600° F. will result in the formation of bainite. However, these steels cannot be made completely bainitic, since after about 60% of the austenite transforms, the remaining austenite becomes stabilized and refuses to transform even with prolonged holding at temperature. According to Baer and Payson (18-161, Sept. 1947), if the partially transformed high speed steel is reheated to about 1050° F. for several hours and again cooled to 450 to 600° F. and held at that temperature for several hours, additional bainite will form. Thus, alternate periods of transformation and tempering will form structures consisting almost entirely of tempered bainite. Steels with this structure have satisfactory hardness for cutting tools, and it has been shown by both laboratory and production cutting tests that tempered bainitic high speed cutting tools outperform tools of the same steel treated by conventional methods.

Here, it seems, is one application for which tempered bainite is superior to tempered martensite. It should also be remembered that the early work of Davenport and Bain showed that austempered high-carbon (eutectoid) steel has an unusual combination of hardness and ductility within a very limited range of hardness.

Our present understanding of austenite decomposition can be summarized as follows:

Austenite decomposes at temperatures above Ms by a process of nucleation and growth, the hardness and structure of the carbide-ferrite aggregates being dependent upon the trans-

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ures of internal friction most commonly used, logarithmic decrement and tangent of the angle with which strain lags behind stress, is deduced for all levels of internal friction in the important case in which the dissipation of energy is due to a relaxation process having a single time of relaxation. The conditions are further derived under which a specimen of such a metal will not vibrate, but returns periodically to its equilibrium configuration.

**3-389. The Strange Behavior of Metals at Very Low Temperatures.** Donald H. Andrews. *Refrigerating Engineering*, v. 54, Nov. 1947, p. 431-435, 482-483.

Fundamental principles of work in the region just above absolute zero, including the phenomena of superconductivity and superfluidity, and the use of bolometers at low temperatures. 17 ref.

**3-390. Interpretation of High Coercivity in Ferromagnetic Materials.** E. C. Stoner and E. P. Wohlfarth. *Nature*, v. 160, Nov. 8, 1947, p. 650-651.

A new theory to explain the above.

**3-391. The Absorption of 17-Mev Gamma-Rays in Lead and Aluminum.** Boyce D. McDaniel, Guy von Dardel, and Robert L. Walker. *Physical Review*, v. 72, Nov. 15, 1947, p. 985-986.

Use of gamma-ray spectrometer. Results from a theoretical standpoint.

**3-392. Carbides, Nitrides and Porosity in Aluminum.** Davidlee Von Ludwig. *Iron Age*, v. 160, Nov. 20, 1947, p. 73-78, 141.

Taking issue with the belief that hydrogen is the primary cause for porosity in aluminum alloys, the author points to carbides and nitrides as the major contaminants. Chemical reactions involving carbon and nitrogen, and the conditions under which they cause a reduction in physical properties. Investigation indicates lack of correlation between strength properties and conventional X-ray examination techniques. Lack of satisfactory analytical methods for isolation and identification of minute amounts of active, nonmetallic constituents.

**3-393. Metallurgical Properties of High Yield Strength Seamless Line Pipe.** A. B. Wilder and J. D. Tyson. *World Oil*, v. 127, Dec. 1947, p. 209-210.

Condensed from paper presented before American Welding Society, Chicago, Oct. 18-24, 1947. See item 3-344.

**3-394. Beryllium in Magnesium Casting Alloys.** Jay R. Burns. *Technical Data Digest*, v. 12, Dec. 1, 1947, p. 5-12.

See item 3-245.

**3-395. The Absorption of Gamma-Rays From $Co^{60}$.** M. V. Mayneford and A. J. Cipriani. *Canadian Journal of Research*, v. 25, Nov. 1947, Sec. A, p. 303-314.

Measurements on beryllium, carbon, $H_2O$, $D_2O$, aluminum, steel, copper, silver, platinum, mercury, lead, bismuth, and uranium; their theoretical interpretation.

**3-396. Thermal Conductivity of Metals at High Temperatures. Part I. Description of the Apparatus and Measurements on Iron.** L. D. Armstrong and T. M. Dauphinee. *Canadian Journal of Research*, v. 25, Nov. 1947, Sec. A, p. 357-374.

Apparatus for the temperature range 0 to 800° C. The method utilizes unidirectional heat flow in a cylindrical sample in a vacuum. Advantages of the method. Measurements on Armco iron indicate that results with an absolute error of less than 2% may be obtained.

**3-397. Molybdenum in Ferrous Base Metals.** G. Fitzgerald-Lee. *British Steelmaker*, v. 13, Nov. 1947, p. 564-568.

Influence on steel alloys; its use in cast iron; foundry technique for producing uniformity of structure of molybdenum cast iron; special purpose steels containing molybdenum.

**3-398. Bibliography on the Fatigue Properties of Cast Iron.** G. R. Woodward. *Bulletin of the British Cast Iron Research Association*, v. 9, Nov. 1947, p. 59-63.

54 references.

**3-399. Application Tables to Guide in the Selection of Materials. Part II.** Zola Fox. *Product Engineering*, v. 18, Dec. 1947, p. 165, 167.

The wrought magnesium alloys and the various casting alloys.

**3-400. On the Pressure-Volume and Pressure-Compressibility Relation of Metals.** P. Gombas. *Physical Review*, v. 72, Dec. 1, 1947, p. 1123-1124.

A statistical theory for the bonds in alkali and alkaline-earth metals. Results of calculation of pressure-volume relations for sodium, potassium, rubidium, cesium, barium, strontium, and magnesium at pressures up to $10^5$ kg. per sq.cm. are charted and compared with Bridgman's experimental results. Agreement between experimental and theoretical curves is quite satisfactory.

**3-401. An Evaluation of Boron-Treated Steels.** Walter F. Toerge. *Steel*, v. 121, Dec. 8, 1947, p. 93-98, 100, 102, 104.

Investigations reported in the past two years furnish convincing proof that boron, when added to medium-carbon steel in very small amounts, exercises powerful influence on certain physical properties of the steel. How the element is introduced and what methods are available for accurately determining its presence.

**3-402. Thermal Expansion of Some Copper Alloys.** Peter Hidnert and Harrison S. Krider. *Journal of Research of the National Bureau of Standards*, v. 39, Nov. 1947, p. 419-424.

Results of investigation of some brasses, bronzes, and other copper alloys for various temperatures between room and 300 °C. 17 ref.

**3-403. Corrosion.** Mars G. Fontana. *Industrial and Engineering Chemistry*, v. 39, Dec. 1947, p. 91A-92A.

Corrosion resistance, mechanical properties, and some uses of a new heat hardenable 18-8 stainless steel known as Stainless W.

**3-404. Carbides for High Temperature Applications.** *Materials & Methods*, v. 26, Dec. 1947, p. 85-86.

A new carbide designed to resist temperatures which rapidly destroy conventional carbide compositions falls into a new category termed "ceramals" containing both metals and compounds.

**3-405. The Physics of Sheet Steel. (Continued.)** G. C. Richer. *Sheet Metal Industries*, v. 24, Dec. 1947, p. 2411-2416.

Fundamentals of ferromagnetism. (To be continued.)

**3-406. Temperature Transitions in Ductility of Steel.** Wendell P. Roop. *Welding Journal*, v. 26, Dec. 1947, p. 748s-752s.

"Temperature transition" refers to the shift in medium steel from ductile behavior at higher temperature to brittle behavior at lower temperature. The temperature limit, which separates two alternative modes of behavior is typically not a sharp boundary but a zone. Two features of the transition zone must be distinguished: position and width. Various zone shapes and their significance; application of the transition curves to specific data.

**3-407. The Permanent Strain in a Uniform Bar Due to Longitudinal Impact.** M. P. White and LeVan Griffis. *Journal of Applied Mechanics*, v. 14 (*Transactions A.S.M.E.*, v. 69), Dec. 1947, p. A337-A343.

A method for predicting the final strained state of a long uniform bar or wire of ductile material subjected to a longitudinal impact of finite duration during which the impact stress is constant and exceeds the yield strength. Various strain zones are delineated and a definite relation is given between the stress history at a point in the specimen and the velocity at that point. (Presented at Annual Meeting of A.S.M.E., Atlantic City, N. J., Dec. 1-5, 1947.)

**3-408. Hardenability.** P. R. Wray. *Iron Age*, v. 160, Dec. 11, 1947, p. 84-89.

The fundamental concepts of hardenability, and the relationship between these concepts and microstructural changes. The derivation and functions of hardenability bands and the means of applying hardenability band data to the solution of steel selection problems.

**3-409. Reheating of 24S and 75S Aluminum Sheet.** J. A. Nock, Jr. *Iron Age*, v. 160, Dec. 25, 1947, p. 73-79.

Changes in strength and elongation values and in resistance to corrosion, occurring at various temperature levels, when reheating the two alloys in the naturally aged and artificially aged conditions. Limitations and possibilities of application of these alloys at elevated temperatures.

**For additional annotations indexed in other sections, see: 14-340; 18-257-263; 22-771; 23-554; 27-254-263-270-275.**

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## 4 STRUCTURE — Metallography & Constitution

**4-196. Grain Growth in Alpha-Brass.** J. E. Burke. *Journal of Applied Physics*, v. 18, Nov. 1947, p. 1028-1029.

A series of isothermal curves plotted from recently published data. An expression including a heat of activation for the process is derived. Calculations presented by Beck, Kremer, and Demer are criticized (see item 4-57).

**4-197. Electron Microscope and Electron-Diffraction Study of Slip in Metal Crystals.** R. D. Heidenreich and W. Shockley. *Journal of Applied Physics*, v. 18, Nov. 1947, p. 1029-1031.

A study of the structure of slip bands using 99.99% aluminum cast in the form of small single crystals.

**4-198. Effects of Germination in C-Alloy Magnesium Castings.** John McCabe and W. H. Sharp. *Metal Progress*, v. 52, Nov. 1947, p. 806-809.

During lathe cutting of the faces of some C-alloy sand castings, the metal chipped or tore rather severely. Metallographic examination showed that grain growth or "germination" had occurred. Factors responsible for this phenomenon. Shot-peening, solution heat treatment, and aging restored fatigue properties to normal.

**4-199. Striations: Metallographic Evidence of Slip.** D. McLean. *Journal of the Institute of Metals*, v. 74, Oct. 1947, p. 95-100.

Regular criss-cross striations were observed under the microscope in lightly deformed brass on sections electrolytically polished and suitably etched. The striations are sections through glide planes that have slipped, and probably indicate nonuniform deformation on these planes.

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formation temperature. Isothermal transformation in the bainite region will not go to completion (especially in high-carbon high-alloy steels) because of austenite stabilization. This stabilized austenite seems to be the result of alloy concentration in the austenite, since holding at a temperature between the pearlite and bainite maxima to allow replacement of the cementite by alloy carbides will condition the austenite so that further transformation to bainite can be accomplished. When austenite is quenched, a certain temperature (Ms) is reached below which transformation (to martensite) becomes spontaneous, the amount of transformation being a function of the degree of cooling below this temperature. In highly alloyed or high-carbon steels, the temperature range for the formation of martensite may be so low that transformation and thermal stresses do not have an opportunity to become relaxed, and cracking of the hard, brittle martensite may result. Martempering is one method of reducing these transformation and thermal stresses to a minimum so as to prevent cracking.

### Tempering and Mechanical Properties

After a steel part has been hardened, it is necessary to temper or partially soften it to attain the proper combination of mechanical properties for the intended service. The effect of a tempering treatment is usually determined by a hardness test. Since different combinations of time and temperature can produce the same hardness, it is of interest to know whether, at a given hardness level, variations in tempering treatment will be reflected by variations in the mechanical properties. Manning and Krumlauf (18-225, and 18-241, 1946 Volume) investigated six aluminum-deoxidized, wrought, low-alloy steels, and found that a good correlation existed between Brinell hardness and tensile strength, yield point, elongation or reduction of area regardless of the tempering practice used. An equally good correlation was observed between Brinell hardness and V-notch Charpy values, provided the steels were not susceptible to temper brittleness.

The study of temper brittleness has been seriously handicapped by lack of a convenient method of showing its presence. This handicap has been at least partially removed by a metallographic etching reagent developed by Cohen, Hurlich, and Jacobson (4-106, 1946 Volume). When etched in a solution of picric acid and zephiran chloride in ethyl ether, steels which are temper brittle are strongly attacked at the grain boundaries while steels free from temper brittleness show no grain boundary attack. The reagent is effective in steels which have been embrittled either by slow cooling from elevated tempering temperatures or by tempering in the range at which embrittlement occurs. The material responsible for temper brittleness precipitates preferentially at the prior austenite grain boundaries.

More work should be done in this field to determine the nature of the phase responsible for temper brittleness, and, if possible, discover ways of rendering it harmless without limiting the tempering treatment to either very high or very low temperatures. However, since it is the final tempered hardness and not the tempering temperature which determines the mechanical properties, combinations of tempering time and temperature can be found for most steels which will give the desired hardness without temper brittleness.

Work reported by Gensamer in 1942 showed that hardness and tensile strength are dependent upon the average carbide particle size and that softening during tempering merely reflects the effect of heating upon the growth of the carbides. Crafts and Lamont (3-189, 1946 Volume), investigating the effects of alloying elements on resistance to tempering, developed a method for calculating the tempered Rockwell C hardness which is accurate to about ±5 numbers. Although this degree of accuracy is too low to be used in calculating heat treatments, it does afford a yardstick for comparing steels and for comparing the effects of alloying upon tempering. The relative effects of alloying elements upon temperability are quite different from their relative effects upon hardenability. After identical heat treatments, steels with equivalent hardenability but different composition may vary considerably in hardness and accompanying mechanical properties. The ratio of tempering resistance to hardenability for alloying elements increases in the following order: boron, carbon, manganese, nickel, chromium, molybdenum, silicon, and vanadium. The amounts of alloys required to reduce softening of a 0.30% carbon steel by one Rockwell C unit after 2 hr. tempering are: 0.77% nickel, 0.40% manganese, 0.22% silicon, 0.19% chromium, 0.06% molybdenum, and 0.03% vanadium.

### Carburization

The solid carburizing compounds used commercially ordinarily produce cases with maximum carbon content of 0.90% or higher. A high carbon concentration in the case is often advantageous, especially if the part must withstand abrasion. However, when abrasion is no problem, and the requirements call for high surface hardness with maximum ductility, there is a definite disadvantage to a high-carbon case. Raising the carbon content above 0.50% increases the hardness very little but does greatly reduce the ductility and toughness of the steel. Therefore, it would seem desirable to produce carburized cases containing no more than 0.50% carbon.

In 1929 Mahin and Spencer reported that additions of fine ferrosilicon to the carburizing compound would produce a hypo-eutectoid case. Rosenthal and Manning (18-164, Sept. 1947) conducted an investigation based on these findings, but the results were erratic. Working on the theory that a very thin layer of silicon on the surface inhibits carburization, they tried a silicon-bearing material plus a chloride mixed with the carburizing compound. The purpose of the chloride was to stimulate the formation of silicon chloride which would in turn precipitate a film of silicon on the surface of the part. Their tests showed that the maximum carbon content in the case was lowered from 0.90 to about 0.45%. The case was uniform in depth and carbon content. When chlorides alone were mixed with the carburizer they acted as energizers, raising the carbon content rather than lowering it. On the basis of the amount added to the carburizing compound for a given decrease in carbon concentration, mixtures of nickel or chromium chloride with ferrosilicon were found to be the most effective. This process should find many useful applications in producing hypo-eutectoid carburized cases.

Stanley (11-125, Sept. 1947) describes carburizing experiments carried out using $BaCO_3$ which contains the radioactive $C_{14}$ isotope. These experiments are designed to clarify the mechanism of carburization and the part played by energizers in the carburization reactions. Kopecki (25-131, Oct. 1947) is also using radioactive tracers to study diffusion rates in metals, and tracers are being used in metallurgical research into some of the fundamental reactions encountered in the heat treatment of steel.

### Controlled Atmospheres

Processes employing controlled or special atmospheres to prevent decarburization or scaling have been used on an industrial scale for a number of years. Many of the gases used are expensive, and sometimes the gas generators present operating problems. Using partially burned city gas as a protective atmosphere, Jenkins (18-24, March 1947) investigated the surface chemistry of steel during heat treatment. Raw city gas is considered to be undesirable because of its explosive nature when mixed with air, and because of the tendency toward sooting at elevated temperatures. However, city gas can be burned in a volume of air insufficient to complete the combustion in such a way that the combustion products are nonexplosive but still retain their original reducing gases such as carbon monoxide and hydrogen, while being free from oxygen and hydrocarbons. Jenkins gives details of design and methods of operating the gas generator so as to prevent scaling, decarburization, and carburization. These matters and more are discussed in a 532-page book (27-15, Feb. 1947).

While investigating the factors which cause quench cracking in airplane propeller steels Liedholm (18-61, May 1947) found that cracking could not be blamed on either carburization or decarburization by the controlled atmosphere. After consideration of all the factors involved, he concluded that the cracking was promoted by hydrogen picked up from the atmosphere.

**4-200. Superconductivity and Structure of Hydrides and Nitrides of Tantalum and Columbium.** F. Hubbard Horn and Waldemar T. Ziegler. *Journal of the American Chemical Society*, v. 69, Nov. 1947, p. 2762-2769.

A survey of published data indicates that in a series of interstitial alloys containing the same parent metal, the superconducting transition temperature varies inversely with the dimension of the lattice parameters, provided the same crystal structure is maintained. Structures of the systems $H_2$-Ta, $H_2$-Cb, and of tantalum nitride and columbium nitride were investigated by X-ray diffraction.

**4-201. The Structure of Tempered Martensite.** W. J. Wrazej. *Canadian Metals & Metallurgical Industries*, v. 10, Nov. 1947, p. 17-22.

X-ray examination of quenched samples tempered at 100° C. for 24 hr. showed that martensite changes on tempering into ferrite and cementite. 11 ref.

**4-202. A New Structural Diagram for Cast Iron.** H. Laplanche. *Metal Progress*, v. 52, Dec. 1947, p. 991-992, 992B, 993.

Maurer's structural diagram was admitted by its originator to apply only to a single size test piece and cooling rate. The original text is quoted to show that the diagram was based on assumptions rather than information. A new structural diagram relates silicon, carbon, and cooling rate to the resulting microstructure.

**For additional annotations indexed in other sections, see:**
**3**-408; **8**-171; **11**-199-209-211-214; **18**-246; **27**-269.

## 5 POWDER METALLURGY

**5-76. Manufacture and Application of Sintered Carbides.** H. Eckersley. *Engineer*, v. 184, Oct. 31, 1947, p. 420-422.

Condensed from papers presented to Institution of Production Engineers.

**5-77. The Economy of Production of Structural Parts by Powder Metallurgy.** Henry W. Fischer and Richard Paul Seelig. *Powder Metallurgy Bulletin*, v. 2, Nov. 1947, p. 128-134.

Cost savings possible for parts which can also be manufactured by other methods.

**5-78. Some Properties of Iron-Silicon Alloys Produced From Powders.** Robert Steinitz. *Powder Metallurgy Bulletin*, v. 2, Nov. 1947, p. 135-137.

Magnetic properties of Fe-Si armatures produced by powder metallurgy. Silicon was varied from 1.5 to 6%. 3% Si and a sintering temperature of about 2150° F. resulted in satisfactory products.

**5-79. Electrolytic Iron Powder Production.** W. J. Granberg. *Iron Age*, v. 160, Dec. 25, 1947, p. 70-72.

A process using insolu'le anodes and a ferrous chloride electrolyte. Power, raw-material requirements, and operating techniques associated with this method are outlined on the basis of an anticipated production rate of 10 tons per day.

**For additional annotations indexed in other sections, see:**
**20**-695; **23**-500-515.

**AMERICAN IRON POWDERS**
By the pound, ton or carload
**SUPERIOR METAL POWDERS CORP.**
**1011 Pelee Street** **Toledo 7, Ohio**

## 6 CORROSION

**6-301. The Theory of the Formation of Protective Oxide Films on Metals. Part III.** N. F. Mott. *Transactions of the Faraday Society*, v. 43, July 1947, p. 429-434.

A new mechanism is proposed to account for the formation of oxide films which grow to a limiting thickness. According to this, electrons can pass the film easily, but ions can only penetrate it in the presence of a very strong field. This mechanism is compared with the author's previous theory based on tunnel effect; further experimental work is required to determine which is correct.

**6-302. Sodium Chloride Versus Construction Materials.** *Chemical Engineering*, v. 54, Nov. 1947, p. 217-218, 220.

Part II of a symposium in which typical materials of construction are evaluated for services involving sodium chloride. High-silicon irons, by Walter A. Luce. Carbon, graphite, by L. C. Werking.

**6-303. Caustic Cracking of Welded Steel Plate.** H. M. Wilten. *Metal Progress*, v. 52, Nov. 1947, p. 803-805.

Above type of failure is said to be very rare. Results of an investigation of the failure, including photomicrographs.

**6-304. Maintenance of Metallic Trim at Rockefeller Center.** Myron Weiss. *Metal Progress*, v. 52, Nov. 1947, p. 833-834.

Experience of ten years with the various metals used.

**6-305. Stability of Aerosol Formulations.** Edmond G. Young. *Soap and Sanitary Chemicals*, v. 23, Nov. 1947, p. 116-117, 152A.

Technique for comparing stabilities using a standard formulation containing DDT. Table shows the amount of corrosion taking place on a test strip of the metal from a commercial aerosol bomb, after holding at 150° F. for several weeks, for 32 different compounds used in such formulations.

**6-306. Sour Crude Equipment Protection.** E. Q. Camp. *Oil and Gas Journal*, v. 46, Nov. 22, 1947, p. 68, 70-71, 73-74. *Petroleum Processing*, v. 2, Dec. 1947, p. 967-972; *Petroleum Refiner*, v. 26, Dec. 1947, p. 100-111.

The major corrosion problems experienced and the methods employed in mitigating them. 25 ref.

**6-307. Corrosion.** J. C. Hudson. *Iron and Steel*, v. 20, Nov. 1947, p. 507-518.

Work of joint committees of the British Iron and Steel Research Assoc. Atmospheric and marine exposure of different steels with different types of coatings. 23 ref.

**6-308. Sour Crude: Equipment Protection for Cracking Units.** E. Q. Camp. *Oil and Gas Journal*, v. 46, Nov. 29, 1947, p. 83-87.

The corrosion encountered and methods employed in its mitigation. Corrosion experienced in thermal cracking of reduced west Texas crude, in cracking of sour distillate in a fluid-catalyst-cracking unit, and in vapor-phase re-forming of a light naphtha.

**6-309. Corrosion Control in Mid-Continent Production.** C. C. Munger. *World Oil*, v. 127, Dec. 1947, p. 172, 174, 176, 178.

Types of corrosion, content of corrosive materials in various fields, and methods used to combat it.

**6-310. Corrosion Resisting Metals and Alloys.** H. J. Butterill. *Canadian Mining and Metallurgical Bulletin*, Nov. 1947, p. 521-526.

Electrochemical theory of corrosion; corrosion of structural steel; stainless steels and other high alloys; protective coatings.

**6-311. Some Factors Affecting the Corrosion of Packaged Metal Parts.** C. G. Lavers, A. H. Woodcock, and J. A. Pearce. *Corrosion and Material Protection*, v. 4, Nov-Dec. 1947, p. 6-10.

The efficiency of intimate wraps and carton overwraps in preventing corrosion of connecting-rod bearing liners of steel faced with a Cu-Pb alloy; of roller-bearing cups of steel with a polished bearing surface; and of push rods (hollow cylindrical steel parts with a polished exterior). Various types of precleaning, grease or oil coating, wax-dipping, coated paper, or fiberboard packing were evaluated.

**6-312. Protective Film Formation on Stainless Steels.** William H. Colner. *Corrosion and Material Protection*, v. 4, Nov-Dec. 1947, p. 11-21.

Methods of studying oxide films and the data derived therefrom for iron, chromium and nickel and their alloys. Several theories of protection by films; the laws of film growth. Some effects of environment and surface condition. 80 ref.

**6-313. Resistance of Aluminum to Corrosion in Solutions Containing Various Anions and Cations.** A. B. McKee and R. H. Brown. *Corrosion*, v. 3, Dec. 1947, p. 595-612.

Effect of various anions and cations on the corrosion rate of aluminum and safe concentrations of acids and bases for contact with aluminum of a number of different solutions. (Presented at Annual Meeting of N.A.C.E., Chicago, April 7-10, 1947.)

**6-314. Thermogalvanic Corrosion. Part II.** R. M. Buffington. *Corrosion*, v. 3, Dec. 1947, p. 613-631; discussion, p. 631.

The subject from a thermodynamic and physicochemical point of view. A test which shows that under certain conditions, the standard thermodynamic relations for reversible systems apply to the open-circuit potentials of thermogalvanic cells. The significance of thermogalvanic data. A method for calculating thermogalvanic potentials from readily available data. 12 ref. (Presented at Annual Meeting of N.A.C.E., Chicago, April 7-10, 1947.)

**6-315. Preventing Rectifier Corrosion.** D. W. Borst. *Coal Age*, v. 52, Dec. 1947, p. 89-93.

The types of corrosion encountered with sealed ignitrons; the effect of potential difference across piping and its elimination; recommended anti-freezes and corrosion inhibitors; electrolytic targets.

**6-316. Mechanism of Cathodic Protection.** R. B. Mears. *Oil and Gas Journal*, v. 46, Dec. 6, 1947, p. 77, 79-80, 82.

Present theories and laboratory and field methods for determining the current density required for complete protection, especially of pipe lines.

**6-317. Corrosion in Boiler Feedwater Treating Systems—Parts II and III.** Leo F. Collins. *Power Plant Engineering*, v. 51, Nov. 1947, p. 114-116; Dec. 1947, p. 114-116, 132.

Causes of corrosion of cast iron in systems involving zeolites, acids, and degasification. Causes of graphitic corrosion. Performance of materials and metals used in such systems and in primary treating equipment. Recommendations for lines carrying cold, hard, and soft waters.

**6-318. Resistance of Sensitized Stainless Steels to Boiling Nitric Acid.** Raymond S. Stewart. *Metal Progress*, v. 52, Dec. 1947, p. 971-973.

The Huey test—boiling stainless steel samples in 65% $HNO_3$ for five 48-hr. periods and determining the corrosion loss—was originally proposed as a means of evaluating the highly resistant alloys in respect to their gen-

*(Turn to page 14)*

# PRODUCTS AND PROCESSES

## *for Heat Treating*

### An Index to New Equipment Developed or Improved During the Past 12 Months

THE FOLLOWING brief notations list the new products and equipment in the heat treating field that have been developed during the past year. Complete details may be secured from the manufacturers by using the Reader Service Coupon on page 19 and specifying the number shown in parentheses after the manufacturer's name.

### Furnaces, Gas Fired

A reciprocating hearth heating machine for bright hardening, carburizing, and Ni-Carbing has a complete seal at the discharge end where the muffle enters the quenching bath; thus the work is totally enclosed during a continuous heat treating cycle in an appropriate protective atmosphere. **American Gas Furnace Co. (1)***

The balanced carbon principle, which gives a scale-free product with a selected surface carbon content, and which was formerly available only for specially designed furnaces, is now incorporated in two smaller standard furnaces, the Balco atmosphere furnace and Balco gas carburizing furnace. **Surface Combustion Corp. (2)***

High-speed gas heating installations utilize novel conveyer systems for heating of bars, tubing and billets, for selective hardening of gears, heating for forging, extruding and drawing, and other specific applications in the production line. **Selas Corp. (3)**

An example of high-speed gas heating is a series of furnaces for reheating of 40-ft. hot processed tubes, ranging from 2½ to 6 in. o.d. Tubes are heated while passing from piercing to sizing at mill speeds up to 150 ft. per min. **Selas Corp. (4)**

A new gas-fired radiant tube roller-hearth furnace for bright annealing and normalizing steel strip continuously has an effective width of 60 in. and capacity to heat 7200 lb. of 27-in. strip per hr. to 1750° F. **Electric Furnace Co. (5)**

A reverse-flow recirculating furnace employs a damper arrangement at the fan outlet to reverse the direction of flow of gases through the work at regular intervals, thus increasing precision and uniformity of treatment. **Sunbeam Stewart Industrial Furnace Division. (6)**

A semimuffle furnace for rapid heating and cooling in a wide temperature range (300 to 2400° F.) has newly designed nozzle-mixing burners fired from staggered positions to give a circular turbulence throughout the heating chamber. **Sunbeam Stewart Industrial Furnace Division. (7)**

A modernized version of the 814-16 high-speed oven furnaces for smaller toolrooms and shops is offered in two temperature ranges (1400 to 1800° F. and 2000 to 2500° F.), both equipped with McKee Walltite burners. **Eclipse Fuel Engineering Co. (8)**

The Model 1-B Eclipse bench-type oven furnace is designed primarily for use where low-pressure air (from 10 to 16 oz.) is available. Single-valve temperature control in the range 1400 to 1600° F. is provided. **Eclipse Fuel Engineering Co. (9)**

For an operating range of 100 to 750° F. (suitable for mold drying, baking paint finishes and tempering of metals) Morrison's Model C oven is built with heater, fan and duct work totally enclosed. **Morrison Engineering Corp. (10)**

Also for use with core and mold ovens or paint drying ovens is a direct-fired gas heater known as the Scroll-Aire; it is of compact design for confined areas, and will burn any type of gas fuel. **Newcomb-Detroit Co. (11)**

An automatic heat treating unit, suitable for either gas or electric heat, is batch-loaded. An automatic controller assures a uniform time-heating cycle, a thorough quench, automatic unloading, and signals the operator for a recharge. **Ipsen Industries, Inc. (12)**

### Furnaces, Electric

New Homo tempering furnace is designed for continuous operation up to 1650° F. Long-life ribbon heater and water-cooled fan motor are among features that enable it to handle big, dense loads on a mass-production basis. **Leeds & Northrup Co. (13)**

A box-type laboratory furnace (Model G-10) with temperatures up to 3000° F. top heat, and for continuous operation as high as 2500° F., is heated by ten Globar heating elements. It may also be used as a muffle furnace, or with carbon blocks for nonoxidizing atmospheres. **Lindberg Engineering Co. (14)**

Eight Globar elements are mounted vertically for close temperature control and even heat distribution in a range of 1100 to 2500° F. in a high-speed furnace for general toolroom use. **Sunbeam Stewart Industrial Furnace Division. (15)**

An Inconel muffle installed in the Treet-All multipurpose furnace for operations up to 1850° F. eliminates the need for purging time and permits use of raw gas atmospheres such as methane without affecting the heating elements. A similar unit with a top limit of 2350° F. is made for hardening high speed steel. **Hevi Duty Electric Co. (16)***

High-speed circulation of air provided by a fan and baffle arrangement is an advantage of the Temp-Rite furnace, designed primarily for tempering toolsteels, but suitable for any operation up to 1250° F. **Hevi Duty Electric Co. (17)**

Temperatures up to 2000° F. can be controlled with a fine degree of selectivity by an 11-position rheostat in a horizontal muffle-type furnace. Heavy nichrome wires are embedded in the muffle refractory, with provision for rapid heat conduction and efficient insulation. **Western Gold & Platinum Works. (18)**

A pusher-type kiln is equipped with small refractory trays (2⅝ x 3¾ in.) that are propelled through a 33-in. firing chamber by means of a variable-speed drive; maximum temperature is 2200° F. **K. H. Huppert Co. (19)**

A selective power modifier for accurately regulating furnace heat within 5° and for eliminating the tendency of the chamber temperature to lag behind the pyrometer is particularly advantageous for low-temperature operation. It is built into two new furnaces of the recirculating air draw type — Model ACL for temperatures to 900° F., and Model ACH, up to 1200° F. **Cooley Electric Mfg. Corp. (20)**

The Cooley Model VK-5 also has the selective power modifier for a broad range of applications between 300 and 2000° F. It heats from cold to top temperature in 1½ hr. **Cooley Electric Mfg. Corp. (21)**

A percentage timer maintains accurate control between 100 and 1800° F. in a small muffle furnace with attached pyrometer that is designed for the laboratory or experimental shop and operates on 110 or 120-volt alternating current. **Jelrus Co. (22)**

*See other products of American Gas Furnace Co. and Surface Combustion Corp. under the heading "Carburizing and Nitriding".

*Hevi Duty's atmosphere generator suitable for use with these two units is described under "Gas Atmospheres and Generators".

*(Turn to page 15)*

eral corrosion resistance. In some quarters, however, its use has been extended to appraise the effect of "sensitizing" heat treatments, which induce accelerated intergranular attack. Data show that such an extension is unwarranted and should be discouraged.

**6-319. Sodium Chloride Versus Construction Materials. Part III.** *Chemical Engineering*, v. 54, Dec. 1947, p. 225-226, 228, 230, 232.

Following articles describe corrosion resistance of the respective materials vs. NaCl brines: nickel, nickel alloys, by W. Z. Friend; protective coatings; rubber lining, by O. S. True; lead, by H. M. Church, Jr.; precious metals, by E. F. Rosenblatt; and tantalum, by Leonard R. Scribner.

**6-320. Determination of Physical Chemical Factors in Stress-Corrosion Cracking of Mild Steel.** M. G. Winterstein, H. J. McDonald, and J. T. Waber. *Welding Journal*, v. 26, Dec. 1947, p. 723s-726s.

A theory of stress corrosion with application to other alloys. In mild steel, stress-corrosion cracking is caused by dissolved nitrogen and by the indirect effects of several other elements. New equipment which permits improved control of variables, rapid testing, automatic records, extrapolation of data to higher temperature, and evaluation of the effect of protective treatments on welded samples. (Presented at 28th Annual Meeting, American Welding Society, Chicago, week of Oct. 19, 1947.)

**For additional annotations indexed in other sections, see:**
3-403; 22-705.

## 7 CLEANING & FINISHING

**7-471. Scale Removal.** E. Bucknall. *Journal of the Birmingham Metallurgical Society*, v. 27, Sept. 1947, p. 355-363; discussion, p. 354-355, 363-377.

A general discussion applicable to both ferrous and nonferrous metals. 15 ref.

**7-472. Paints in Railway Service; Some Factors Affecting Their Choice.** F. G. Dunkley and D. P. Earp. *Journal of the Oil & Colour Chemists' Association*, v. 30, Oct. 1947, p. 391-417.

Surface preparation, methods of application, method of construction and nature of materials, accessibility, function, conditions of service, cleaning, and other related topics. Details of test procedures used by British Railway Co.

**7-473. Design of Exhaust Systems.** F. H. Stebbins. *Sheet Metal Worker*, v. 38, Nov. 1947, p. 59-61.

Paint spray-booth system.

**7-474. Evaluating the Workability of Sheet Steel Ground Coats.** E. E. Howe and L. A. Johnson. *Better Enameling*, v. 18, Nov. 1947, p. 6-10, 34.

Three test procedures; comparative test data on three commercial frit combinations. (To be continued.)

**7-475. The Development of Porcelain Enameled Kitchen Utensils During the Period 1941-1947.** F. A. Petersen. *Better Enameling*, v. 18, Nov. 1947, p. 11-13.

Changes in enamel thickness, impact, thermal shock, and solubility resistance of enameled kitchen utensils.

**7-476. Seeger Refrigerator Co. Pioneers the Use of Porcelain Enamel in the Freezer Field.** *Better Enameling*, v. 18, Nov. 1947, p. 14-19.

Procedures, layout, and equipment in manufacture of Coldspot home freezers.

**7-477. Factors to Consider in Hot Dip Galvanizing. Part II. (Concluded.)** A. D. Wilcox. *Industrial Heating*, v. 14, Nov. 1947, p. 1812, 1814, 1816, 1818, 1820, 1856.

Construction of galvanizing kettles; application of heat to the kettle, with special reference to placing of the burners; methods of heating the kettles; the importance of proper temperature control and methods of attaining it; burner selection.

**7-478. Painting and Enameling of Domestic Units at "Hotpoint" Appliance Plant. Part II.** *Industrial Heating*, v. 14, Nov. 1947, p. 1879-1880, 1882, 1884, 1886-1888.

The porcelain-enameling installation, including the enamel-firing furnaces, and automatic and visual methods of color grading.

**7-479. Surface Preparation of Semifinished Toolsteel.** S. F. Magis. *Iron and Steel Engineer*, v. 24, Nov. 1947, p. 78-91; discussion, p. 91.

Chipping, grinding, and some of the metallurgical methods employed in maintaining the surface quality of semifinished toolsteel for rolling and forging. Illustrated. (Presented at A.I.S.E. Philadelphia District Section Meeting, Dec. 7, 1946.)

**7-480. Cleaning and Spray Pickling.** H. C. Ellinger. *Enamelist*, v. 24, Nov. 1947, p. 17-20, 60.

Presented at the 9th Annual Forum, Porcelain Enamel Institute, Columbus, Ohio, Sept. 10-12, 1947.

**7-481. Finishing Setup for a Variety of Metal Products.** Fred M. Burt. *Industrial Finishing*, v. 24, Nov. 1947, p. 36-40, 42.

Procedures and equipment for finishing die-cast products of aluminum, magnesium, zinc, and manganese bronze.

**7-482. Surface Preparation and Painting Setup.** *Industrial Finishing*, v. 24, Nov. 1947, p. 42, 44.

New 5-stage conveyerized Bonderizing system.

**7-483. The Pullman-Standard Finish.** W. J. Boltze. *Industrial Finishing*, v. 24, Nov. 1947, p. 54-56, 60, 62.

Methods used in painting and decorating modern streamlined passenger cars. (To be continued.)

**7-484. Automatic Finishing Setup for Refrigerator Cabinets.** *Industrial Finishing*, v. 24, Nov. 1947, p. 64, 66.

**7-485. Tumble Finishing Toys.** Howard Ford. *Industrial Finishing*, v. 24, Nov. 1947, p. 71-72.

Use of barrel finishing for application of paint to small metal toys found in boxes of popcorn.

**7-486 Protective Metallic Coatings From Molten Salts** Harry R. Hoge. *Metal Progress*, v. 52, Nov. 1947, p. 819-823.

Wartime study of methods, for producing a uniformly thin, yet continuous, metallic layer so thin that fine dimensional tolerances would not be disturbed, led to the use of fused baths of certain metallic salts. One such bath consisted of tin chloride, either pure or diluted with relatively small amounts of ammonium or other chlorides, or having some metallic tin dissolved in it. Action of such baths on steel articles.

**7-487. Phosphate and Colored Plastic Coatings.** George H. Pimbley. *Organic Finishing*, v. 8, Nov. 1947, p. 9, 13, 15, 17, 64.

Dual process for protection and decoration of metals.

**7-488. Some Aspects of Metal Finishing.** H. H. Zimmerman. *Organic Finishing*, v. 8, Nov. 1947, p. 19-29.

Methods of finishing, used for metal furniture, counters and shelving.

**7-489. Naval Air Station Resin Coating Shops.** George W. Grupp. *Organic Finishing*, v. 8, Nov. 1947, p. 47-49.

Procedures and equipment for cleaning and finishing of metal surfaces.

**7-490. Operating the World's Largest Porcelain Enameling Plant.** Dan J. Cherry and Robert J. Baker. *Finish*, v. 4, Dec. 1947, p. 15-19, 32-33.

Production of all-porcelain refrigerator cabinets, all-porcelain automatic washers, electric ranges, and porcelain parts for refrigerators, water coolers, and water heaters at Frigidaire.

**7-491. The Surface Preparation of Aluminum for Paint Systems.** *Aluminium and the Non-Ferrous Review*, v. 12, July-Sept. 1947, p. 54, 56.

Condensed from brochure issued by Northern Aluminium Company, Ltd., Banbury, Oxon, England.

**7-492. Electroless Plating on Metals by Chemical Reduction.** *Steel Processing*, v. 33, Nov. 1947, p. 677-678, 687.

New process developed at National Bureau of Standards for plating nickel and cobalt on metal surfaces without use of electric current.

**7-493. How to Choose the Correct Type of Porcelain Enamel for Specific Applications.** J. E. Hansen. *Steel Processing*, v. 33, Nov. 1947, p. 688-693.

Presented at 9th Annual Porcelain Enamel Institute Forum, Columbus, Ohio, Sept. 10-12, 1947.

**7-494. Roto-Finishing Method for Processing Metals.** C. H. Castle. *Machine and Tool Blue Book*, v. 43, Dec. 1947, p. 158-160, 162, 164, 166, 168.

Roto-Finishing is fundamentally a barreling method employing wet mixtures of specially developed chips and compound for finishing ferrous and nonferrous metals and alloys. Principles and applications.

**7-495. Simple Dip Finish.** *Die Castings*, v. 5, Dec. 1947, p. 59-61.

A simple zinc plate followed by a Unichrome clear dip produces a clear conversion coating which looks like chromium plate when applied to die castings. The dip treatment forms a clear conversion coating consisting of zinc oxide and zinc chromate, which has the same kind of eye appeal as chromium plate.

**7-496. Practical Facts About Polishing and Buffing Compounds. Part II.** Howard J. McAleer. *Die Castings*, v. 5, Dec. 1947, p. 62, 64, 66.

What is accomplished by buffing and polishing; the types of compounds employed; abrasives and binders; methods of spray gun application.

**7-497. What You Don't See.** *Refrigeration Industry*, v. 4, Dec. 1947, p. 38-39.

Phosphating and enameling procedures used in manufacturing refrigeration equipment.

**7-498. Barrel Polishing of Small Brass Parts.** T. S. Blair. *Iron Age*, v. 160, Dec. 4, 1947, p. 77.

Polishing of small brass paper fasteners using dry maple sawdust.

**7-499. Health Hazards of Metal Cleaning Compounds.** P. M. Van Arsdell. *Organic Finishing*, v. 8, Nov. 1947, p. 30-33, 36-41.

Hazards from alkaline cleaners and hydrocarbon solvents. 11 ref. (To be continued.)

**7-500. Selection of Protective Coatings.** K. G. Compton. *Canadian Chemistry and Process Industries*, v. 31, Nov. 1947, p. 1027-1030, 1033.

The electrochemical theory of corrosion; types of coatings; testing of coatings; and selection.

**7-501. Deposition of Nickel and Cobalt by Chemical Reduction.** Abner Brenner and Grace Riddell. *Journal of Research of the National Bureau of Standards*, v. 39, Nov. 1947, p. 385-395.

Extension of process developed for depositing nickel and cobalt from hot solutions of hypophosphite without the use of current to include deposition of nickel from acid solutions and of cobalt and cobalt-nickel alloys from ammoniacal solutions.

**7-502. Abrasive Tumbling Reduces Fin-**

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## Furnaces for Special Purposes

Annealing as a substitute for pickling in the preparation of parts for porcelain enameling is accomplished in a roller hearth furnace. The 1550° temperature volatilizes the drawing compounds, flow of gas washes away the volatilized compounds, and the constituents of the gas reduce any oxides present. **General Electric Co. (23)**

Conversion of large nitriding furnaces used in war work to bright annealing has required certain modifications to increase the temperature range slightly, and to provide auxiliary equipment for complete dissociation of ammonia. **Metlab Co. (24)**

Selective annealing prior to rolling of washing machine tubs is done by rotating the stamping in a chamber fired by a series of high-velocity gas burners around the top band; the section comes to heat in only 20 to 30 sec. **Gas Appliance Service, Inc. (25)**

An electric age hardening oven installed in the Seattle plant of Boeing Aircraft Co. is 8 ft. wide by 12 ft. high by 45 ft. long, and can be divided into two compartments if desired. Time and temperature controls can be operated individually in each compartment to a tolerance of ±3° F. **Lanly Co. (26)**

An oil-fired continuous spiral screw-conveyer furnace is especially designed for heating nonferrous billets for piercing. This installation handles billets up to 52 in. long and has sufficient burner capacity to heat over 5½ tons of billets per hr. to 1650° F. **Electric Furnace Co. (27)**

Rapid heating plus temperature control to within ±5° F. makes it possible to flame harden parts to dimensional tolerances and metallurgical specifications hitherto impractical for production quantities. Operation of the Flamatic is fully automatic except loading. **Cincinnati Milling Machine Co. (28)**

## Carburizing and Cyaniding

"Homogeneous carburizing" is a process which, by increasing and almost simultaneously diffusing and equalizing the carbon content of strip steel (following fabrication into desired forms), permits the use of low-carbon steel for parts such as leaf springs, clips, clamps or flexible disks. The lengthy spheroidizing or annealing cycles required by higher carbon steels are eliminated. **Surface Combustion Corp. (29)**

A vertical carburizing furnace has a retort 22 in. diameter by 7 ft. high; recirculation is provided by a fan at the top. **American Gas Furnace Co. (30)**

For continuous carburizing of small work a rotary retort furnace with an internal spiral has been improved by the addition of a completely sealed heat resisting alloy roller bearing to support the retort at the discharge end, and a completely enclosing hood at the discharge end. **American Gas Furnace Co. (31)**

A rotary carbo-nitriding (or gas cyaniding) furnace operates automatically once a tray of work is placed on the elevator and the outer door closed. A time clock mechanism opens the inner door, pushes the tray onto the furnace hearth, which is rotated until the work is brought to the loader, where it is transferred onto an elevator and into the quench tank; a transfer arm in the quench tank then places the tray on the discharge elevator for unloading. **Holcroft & Co. (32)**

Innovations in another batch furnace for gas cyaniding are in methods of rapid heating of cold charge by an interchange of heat with an "accumulator" built into the furnace walls, the continuous adjustment of gas atmosphere to the work temperature by an ingenious placement of catalyst tubes, and oil quenching by a cascade of liquid. **Dow Furnace Co. (33)**

## Gas Atmospheres and Generators

Lithium atmospheres for clean, scale-free and nondecarburizing heat treatment are introduced with the usual carrier gas into the heating chamber of universal batch furnaces made in 13 standard muffle sizes. The lithium vaporizer is built into the furnace at the rear and is heated separately. **Lithium Co. (34)**

The Atmo-Gen atmosphere generator consists of an electrically heated vertical tube furnace containing an alloy retort filled with catalyst. Ammonia gas is cracked to form nitrogen and hydrogen; carbon potential is controlled by addition of a hydro-carbon gas. **Hevi Duty Electric Co. (35)**

The Hi-Nitrogen generator for producing nitrogen up to 99% purity or mixed with up to 10% combustibles incorporates horizontal immersion tube burners which supply both the base atmosphere and heat for reactivation of the carbon dioxide absorbent. Gas diffusers are installed for dispersion of the gas into tiny bubbles. **Gas Atmospheres, Inc. (36)**

The Gordon atmosphere indicator and recorder operates on the simple principle of thermal conductivity of gases; a change in any constituent element alters the thermal conductivity of the atmosphere mixture, causing a different reading on the dial. **Claud S. Gordon Co. (37)**

## Salt Baths

Cyclic annealing of forgings in salt baths utilizes the residual heat in the forging as it comes from the press. It is immersed in the bath, which is held at subcritical transformation temperature, for sufficient time to permit complete transformation. Advantages are uniformity, freedom from scale, and reduction of the annealing period from the conventional 6 to 24 hr. to ¼ to 2 hr. **E. F. Houghton & Co.** and **Ajax Electric Co., Inc. (38)**

The Ajax isothermal quench furnace employs the principles of a heat exchanger to hold the quenching bath at constant temperature. Other features are a submerged pump for vigorous agitation of the bath and a salt separator immersed directly in the bath. **Ajax Electric Co., Inc. (39)**

Molten alloy electrodes that operate at 900° F. to heat the salt bath to 1600° F. offer several advantages in addition to longer electrode life: Smaller surface area of the bath reduces radiation losses up to 25%; contamination and rate of rectification are reduced; sludge is easily removed by scooping from the surface of the molten alloy; with proper alloy and new design of power conductors, voltage drop from transformer to the bath is negligible. **A. F. Holden Co. (40)**

A battery of six electric salt bath furnaces (bottom electrode type) covers the complete range of work in a midwest commercial heat treating plant, including hardening and drawing, isothermal treatments, liquid carburizing, cyaniding, double preheat for high speed steel, and treatment of stainless steel. **Upton Electric Furnace Division. (41)**

Perliton "W" is a new water-soluble carburizer that permits easy cleaning and operates at temperatures up to 1575° F.; rate of carburization at that point is equivalent to that of a barium cyanide bath at 1650° F. **E. F. Houghton & Co. (42)**

Another water-soluble carburizer is Du Pont's accelerated salt WS, designed for the temperature range 1500 to 1650° F.; fluidity, high activity and good stability characterize baths prepared from it. **E. I. du Pont de Nemours & Co. (43)**

Uni-Hard is a multipurpose salt bath with a working range of 1050 to 1800° F. It permits the use of a single salt and a single furnace for a wide variety of operations. **Heatbath Corp. (44)**

## Induction Heating

A new low-cost induction heating unit that plugs into a 110-volt wall socket and requires no water connections is the 750-watt, 450,000-cycle Toccotron—a bench-type machine designed primarily for silver brazing and soldering, but also adaptable to certain hardening, annealing and forging applications. **Ohio Crankshaft Co. (45)**

The Ther-Monic Model 43 (designating a full-load output of 43 B.t.u. per min.) is also a 750-watt, 450,000-cycle, bench-type generator. It is contained in a portable cabinet 29x16½x19 in. in dimension. **Induction Heating Corp. (46)**

A 1-kw. bench-type heater that operates at 3 or 6 megacycles to provide extremely fast heating to high temperatures is known as the SI-1. Larger units for heavier production that also operate at this frequency are the SI-2 (2 kw.) and the SI-15 (15 kw.). **Sherman Industrial Electronics Co. (47)**

The Ajax-Northrup 20-kw. high-frequency converter for induction heating and melting features simple con-

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**lshing Cost.** Vallory H. Laughner. *Machinery*, v. 54, Dec. 1947, p. 139-146.

New applications for deburring, cleaning, and finishing operations both in job shops and high-production plants.

**7-503. Electrolytic Polishing of Carbon-Manganese Steel.** Charles L. Faust. *Monthly Review*, v. 34, Dec. 1947, p. 1365-1366, 1399.

Critically reviews paper by W. A. Spark, *Journal of the Electrodepositors' Technical Society*, v. 21, 1946, p. 245.

**7-504. Organic Finishes for Metals.** H. R. Clauser. *Materials & Methods*, v. 26, Dec. 1947, p. 95-106.

Selection of finishes; composition of organic finishes; undercoats; finish coats.

**7-505. The Electrolytic Polishing of Brass Pressings.** P. Berger. *Sheet Metal Industries*, v. 24, Dec. 1947, p. 2437-2443.

Of three processes described in the patent literature only the chromic acid process gave good results. However, it was necessary to modify this process considerably. Compositions and operating procedures. Applicability to various alloys and to plant layout and procedures.

**7-506. Cleaning and Phosphate-Coating Home Appliances at Hotpoint, Inc.** Norman P. Gentieu. *Products Finishing*, v. 12, Dec. 1947, p. 16-18, 20, 22, 24.

**7-507. Barrel Finishing of Metal Products. Part 16—A Discussion of Round Cylinder Barrels as Distinguished From Six or Eight-Panel Barrels.** H. Leroy Beaver. *Products Finishing*, v. 12, Dec. 1947, p. 28, 30, 32, 34, 36, 38, 40.

**7-508. Some Information on Lithium-Bearing Ground Coat Enamels.** Paul A. Huppert. *Better Enameling*, v. 18, Dec. 1947, p. 6-7, 35.

One series of tests using a special steel not yet considered suitable for porcelain enameling, and using regular enameling stock and another involving a ground coat into which was introduced various amounts of lithium manganite.

**7-509. Evaluating the Workability of Sheet Steel Ground Coats. (Concluded.)** E. E. Howe and L. A. Johnson. *Better Enameling*, v. 18, Dec. 1947, p. 8-10, 30.

Test procedures used to evaluate resistance to copperheading, compatibility with other ground-coat compositions, surface texture, and thermal expansion.

**7-510. New Processes of Porcelain Enameling.** F. L. Meacham. *Better Enameling*, v. 18, Dec. 1947, p. 18, 29.

New processes contemplate the application of a finish coat directly to the metal, eliminating the conventional ground coat now used and, in some instances, a much lower enameling temperature. Both of these contemplated changes presuppose the use of new types of enameling steels with or without special surface treatment.

**7-511. Applications of Zinc Coatings by Hot Dipping.** Robert Steele. *Metal Finishing*, v. 45, Dec. 1947, p. 71-76.

Two major operations are involved in galvanizing: preparing the surface and immersion in a bath of molten zinc. Variations of the final coating or speltering; the equipment required; character of the coatings; pickling processes.

**7-512. Testing of Alkaline Metal Cleaners.** A. Mankowich. *Metal Finishing*, v. 45, Dec. 1947, p. 77-78, 88.

The limitations and advantages of various methods.

**7-513. Modern Mechanical Surface Finishing. (Concluded.)** Martin Manler. *Metal Finishing*, v. 45, Dec. 1947, p. 82-88.

Various factors affecting the efficiency of polishing wheels, buffs, belts, and buffing compounds, with emphasis on the variations required for different metals.

**7-514. Precision Tumbling Metal Parts.** R. M. Lord. *Steel*, v. 121, Dec. 15, 1947, p. 93-94, 124.

Using specially prepared abrasives, the process is successful in operations such as cleaning, deburring, forming radii, surface finishing, and removing plating and paint.

**7-515. Fine-Grit Lubricated Belt Finishing.** A. D. Stout, Jr. *Iron Age*, v. 160, Dec. 18, 1947, p. 68-71.

Some typical production operations, in which the finished product has been improved by use of proper lubricants for abrasive belts. Special equipment developed for polishing zinc and stainless sheet.

**For additional annotations indexed in other sections, see: 6**-307; **8**-181; **11**-200-203-207-212; **21**-111; **22**-719; **23**-533-536; **27**-259.

## 8 ELECTROPLATING

**8-171. The Structure of Hard Chromium Deposits on Steel.** H. J. Goldschmidt. *Metallurgia*, v. 36, Oct. 1947, p. 297-302.

Investigation by X-ray analysis shows that the base metal plays a vital part and that the structure of the interface between it and the deposit largely decides the properties of the plating. Structural changes on annealing at temperatures up to 1000° C. Three classes of occluded hydrogen are distinguished, according to the firmness of binding in the lattice. The effect of external friction on the plating structure is essentially different in the poor and good quality types. 17 ref.

**8-172. Electrodeposition of Tungsten Alloys Containing Iron, Nickel, and Cobalt.** Abner Brenner, Polly Burkhead, and Emma Seegmiller. *Journal of Research of the National Bureau of Standards*, v. 39, Oct. 1947, p. 351-383.

Deposits are smooth, strong, and brittle. The nickel and cobalt alloys become ductile on heating. As plated, the nickel and cobalt alloys have a hardness of 350 to 700 Vickers, and the iron alloy, 700 to 900 Vickers. The alloys undergo precipitation hardening and the cobalt-tungsten alloys retain their hardness when hot. 27 ref.

**8-173. Anodes, Part VI. Operating Factors Involved in the Utilization of Chromium.** E. R. Thews. *Metal Industry*, v. 71, Oct. 24, 1947, p. 343-344.

See item 8-157.

**8-174. Copper Plating; Cyanide-Free Electrolyte for Coppering Steel.** A. Levin. *Electroplating*, v. 1, Nov. 1947, p. 25-27.

A laboratory investigation of copper sulphate-oxalate baths with and without organic addition agents. Alkaline copper sulphate-ammonium oxalate electrolytes appear to possess some interesting possibilities. (Translated and condensed from *Journal of Practical Chemistry (U.S.S.R.)*, v. 14, no. 1, 1941, p. 74-78.)

**8-175. Rapid Plating Range Test.** J. B. Mohler. *Iron Age*, v. 160, Dec. 4, 1947, p. 75-76.

Plating range test is designed to enable platers to maintain the plating range for chromic acid baths at a maximum without requiring continual chemical analyses. It may also be effectively applied to chromate baths using catalysts other than sulphuric acid.

**8-176. Tungsten Alloy Electrodeposition.** *Iron Age*, v. 160, Dec. 4, 1947, p. 70.

New method recently reported by the National Bureau of Standards.

**8-177. Anodic Reactions of Aluminum and Its Alloys in Sulphuric and Oxalic Acid Electrolytes.** Ralph B. Mason and Charles J. Slunder. *Industrial and Engineering Chemistry*, v. 39, Dec. 1947, p. 1602-1607.

Factors which affect the formation of aluminum oxide produced by the anodic treatment of aluminum in sulphuric and oxalic acid electrolytes. Purity of the aluminum anode has a marked effect upon the efficiency of oxide coating formation, the highest efficiency being obtained with pure aluminum.

**8-178. Fatigue Limit of Chromium-Plated Steel.** Louis Mehr, T. T. Oberg, and J. Teres. *Monthly Review*, v. 34, Dec. 1947, p. 1345-1359.

A systematic study of the effects of different variables on the fatigue limit. Attempts to develop a process which would cause such a low fatigue loss that the necessity for testing each plated part could be dispensed with. It was concluded that chromium plate cannot be applied indiscriminately to highly stressed areas subject to vibration. Each application to aircraft parts should undergo a test with a sufficient number of cycles to determine serviceability.

**8-179. Laboratory Apparatus for Controlled Current Distribution on Small, Flat Specimens.** J. B. Mohler and R. A. Schaffer. *Monthly Review*, v. 34, Dec. 1947, p. 1361-1364.

Apparatus using the principle of insulating boundaries in electroplating. Insulating walls between the anode and the cathode can be conveniently substituted for apparent distance which equalizes the current density on all points of the cathode or can be used to obtain a uniformly varying current density.

**8-180. The Influence of the Basis Metal in Electroplating.** R. Piontelli. *Sheet Metal Industries*, v. 24, Dec. 1947, p. 2399-2404, 2416.

Experiments on the deposition of lead on various cathodes showed that, for a given current density, the number of "centers of crystallization" varied considerably with the nature and surface condition of the base metal. The importance of surface irregularities in creating local conditions favorable to the formation of nuclei. Possible mechanisms of electrodeposition in the light of fundamental lattice considerations. 18 ref. (Presented at recent International Conference on Electrodeposition.)

**8-181. Plating of Die Castings Including Buffing, Cleaning, Plating and Stripping.** C. F. Nixon. *Products Finishing*, v. 12, Dec. 1947, p. 42, 44, 46, 48, 50, 52, 54, 56, 58.

Plated die castings for the Fisher Body and automotive divisions of General Motors. (A paper presented to the American Electroplaters' Society.)

**8-182. Alloys by Electrodeposition.** J. B. Mohler and H. J. Seducky. *Metal Finishing*, v. 45, Dec. 1947, p. 65-70.

Practical points which must be considered in development of new plating baths for deposition of alloys. Properties of some well-known electrodeposited alloys and future prospects. 20 ref.

**8-183. Introductory Survey of Electroplating. (Concluded.)** Rick Mansell. *Metal Finishing*, v. 45, Dec. 1947, p. 79-81.

General plating practice—racks, tanks, and electrical equipment.

**8-184. Tanks and Linings for Electroplating.** *Metal Finishing*, v. 45, Dec. 1947, p. 91.

**8-185. Common Plating Bath Troubles—Their Causes and Cures.** J. B. Mohler. *Iron Age*, v. 160, Dec. 11, 1947, p. 98-101, 170.

Rough, burnt, off-color, peeled, brittle, cracked, blistered, spotty, and

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trols, safety interlocks, and new streamlined housing. **Ajax Electrothermic Corp. (48)**

Improvements and changes in the Allis-Chalmers 20-kw. electronic heater include an output transformer with a higher coefficient of coupling, a capacitor with a greater safety factor, a redesigned main power transformer, tapped transformers to allow a wider range of operating voltages, and thermal protection on the cooling system. **Allis-Chalmers Mfg. Co. (49)**

An easily installed 20-kw., 450-kc. unit consolidates generator, worktable or sink, current transformers and water fittings into minimum floor space. Three types are available—A, a single-position unit for brazing and soldering; Type B, a single-position unit for hardening; and Type C, a versatile two-position unit. **Westinghouse Electric Corp. (50)**

For high production jobs such as hardening gears and automotive parts, or progressive and selective shaft hardening, a 50-kw., 450-kc. generator with matching two-position worktable containing a built-in sink is offered. **Westinghouse Electric Corp. (51)**

Ecco high-frequency motor-generator sets are supplied in power outputs ranging from 20 to 1250 kw. and frequencies from 960 to 10,000 cycles. **Ecco High Frequency Corp. (52)**

An improved automatic turntable for the continuous soldering, brazing and annealing of small parts is equipped with small cup-like receptacles for positioning the parts. **Lepel High Frequency Laboratories, Inc. (53)**

A conveyer belt table is powered by a ¼-hp. motor; belt speed may be regulated over a wide range, and interchangeable supports can be fastened to the belt to hold parts of various shapes. **Lepel High Frequency Laboratories, Inc. (54)**

Five new electron tubes for use in equipment of 5 to 50 kw. rating are ruggedly built with heavier metal sections, sturdier anodes, grids, cathodes and terminals; they are designed primarily for industrial heating applications. **Machlett Laboratories. (55)**

## Burners, Valves, Fuel Generators

Heart of the Bryant Pow-R-Pac industrial gas burner is the newly developed Bryant Mixjector, a short and compact proportional mixing device that uses air from a constant pressure blower and draws gas through a zero governor in the gas line. Air-gas ratio is set by a single, easily locked adjustment. **Bryant Heater Co. (56)**

A gas-air mixer with an inspection window in the air inlet permits the operator to check performance by observing piston and valve operation. The mixture ratio is independent of fluctuations in gas pressure or changes in output demand. Control mechanism is located on the air inlet side. **Gas Appliance Service, Inc. (57)**

McKee cone-type diluters for automatic gas-air premix systems are now made with an adjustable compensator mechanism that enables the operator to make a richer mixture by opening adjustable slides so that a portion of the gas can bypass the gas cone. **Eclipse Fuel Engineering Co. (58)**

A complete line of industrial burner equipment, including mixers, nozzles, valves and blowers, is described in a new bulletin. **Maxon Premix Burner Co. (59)**

The Series 18 Soft-Seat atmospheric regulator, while designed expressly for supplying atmospheric gas to premix systems, is also applicable to single-valve control with nozzle-mix systems; a soft, synthetic rubberized fabric facing insures tight shut-off. **North American Mfg. Co. (60)**

A metering oil valve cleans itself by the sweeping action of a cleaning pin that clears sediment out of the V-groove; a triangular orifice prevents clogging and flame fading troubles. **Hauck Mfg. Co. (61)**

Latest improvements in the Vapofier—a compact unit for producing safe, low-cost gas from fuel oil—are foolproof alignment of parts, attractive appearance and less weight (a new aluminum chassis). The Vapofier automatically maintains constant manifold pressure and air-gas ratios from a reducing to an oxidizing flame. **Vapofier Corp. (62)**

Where impending gas shortages may interfere with normal production, new oil standby equipment utilizing No. 3 furnace oil or lighter, and providing the same B.t.u. input per hour as existing gas burners, is available. For some types of burners, the equipment may be installed permanently and the burners operated on oil or gas merely by control valve manipulation; for other types it is only necessary to change the spud or discharge nozzle. **Surface Combustion Corp. (63)**

To provide for emergencies caused by power failures, North American Mfg. Co. is expanding its regular line of turbo blowers to include a unit powered by an internal combustion engine. For combustion systems using oil burners, an oil pump may be had as an integral part of the unit. **North American Mfg. Co. (64)**

## High-Alloy Furnace Parts

Recent applications of Hastelloy nickel-base alloys in heat treating equipment include flasks, trays, tracks, and furnace parts in ovens for baking molds at temperatures ranging from 1400 to 1900° F. (two years' continuous operation); cyanide racks that are preheated by gas flame to 700° F., then placed in a bath at 1625° F. for 30 min. and oil cooled (one year service, 8 hr. a day); and cyanide baskets not preheated but placed in a bath at 1575° for 15 and 30 min. and water cooled (three years' service). **Haynes Stellite Co. (65)**

Two examples of custom-designed Inconel equipment that save weight by being fabricated and welded rather than cast are a furnace muffle made of ⅜-in. plate (⅝ in. when cast) and a grid and screen unit used for hardening valve stems in a pit furnace. The latter weighs only 249 lb. as against 410 lb. for a cast fixture. **Rolock, Inc. (66)**

A heat treating retort formerly made with a cast top and bottom has been redesigned so that only the top and upper sealing trough are cast integrally. **Stanwood Corp. (67)**

Ohioflex trays made of Fahrite alloys are so constructed as to permit expansion and contraction in all directions—a particularly desirable feature in quenching, where mechanical stress is caused by sudden temperature change. **Ohio Steel Foundry Co. (68)**

A series of technical articles on woven wire conveyer belts for industrial applications are contained in a 56-page booklet. Cambridge Wire Cloth Co. **(69)**

## Refractories and Insulation

A concrete which withstands temperatures as high as 3000° F. and can be either poured like ordinary concrete or used as a ramming mixture is known as B & W Kaocast. **Babcock & Wilcox Co. (70)**

Carbofrax (a product of Carborundum Co.) refractory radiant heating tubes and Carbofrax hearth rollers are incorporated in Gasmaco industrial furnaces which can be used for controlled atmosphere heat treating at temperatures up to 2500° F. with gas heat. **Gas Machinery Co. (71)**

Zonolite brand vermiculite—a rare form of mica that expands when heated—can be used as insulation for the slow cooling of steel and welded parts; it will resist temperatures up to 2300°. **Universal Zonolite Insulation Co. (72)**

## Miscellaneous Accessories

A furnace lighter has, instead of an exposed flame, a perforated heat resisting alloy nozzle tip where combustion takes place, heating it to incandescence; it will stay lit regardless of the atmosphere or back pressure in the furnace. **Sunbeam Stewart Industrial Furnace Division. (73)**

Installation of variable speed control equipment permits the use of a single furnace for heat treating various sizes and types of parts; speed of the heat treating cycle can be controlled to fractions of a minute. **Reeves Pulley Co. (74)**

Automatic control of the quenching bath temperature is assured by use of a self-contained oil cooler that circulates oil from the quench tank, cools and strains it, and pumps it back at a rate which keeps the temperature exact. **Bell & Gossett Co. (75)**

An aftercooler and separator for use with compressed air systems not only cools the air but also removes oil and moisture. It is of the "air tube" design, in which cooling water is directed back and forth across the tubes by baffles. **Bell & Gossett Co. (76)**

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pitted deposits are diagnosed and cures suggested. Testing and control methods, both general and specific; a continuous purification system.

**8-186. Electrodeposition of Tungsten Alloys on Metal Surfaces.** *Steel*, v. 121, Dec. 29, 1947, p. 63, 66.

Process developed at National Bureau of Standards.

**For additional annotations indexed in other sections, see: 7-492; 10-244-245; 11-212.**

## 9 PHYSICAL TESTING

**9-173. The Effect of Notching on Materials of Construction Under Static and Dynamic Tension. (Maximum Testing Velocity 29 Ft. Per Sec.) (Continued.)** Georges Welter. *Metallurgia*, v. 36, Oct. 1947, p. 339-343; v. 37, Nov. 1947, p. 36-40.

Presentation of experimental data. (See item 9-149.)

**9-174. A Simplified Warm Hardness Test for Temperatures Below 700° F.** A. L. Pranses. *Instruments*, v. 20, Nov. 1947, p. 1006, 1066.

Simple apparatus for determining hardnesses of metals and other solid materials at elevated temperatures, using the Rockwell machine.

**9-175. Measuring the Elastic and Plastic Properties of Wire.** *Wire Industry*, v. 14, Nov. 1947, p. 617-618.

An instrument developed for the above purpose. (Condensed from report by J. Mickleraith, *Coil Spring Journal*, no. 8, Sept. 1947.)

**9-176. High-Magnification Stress-Strain Charts.** J. Orwig Jones. *Machinery (London)*, v. 71, Nov. 6, 1947, p. 513-515.

Electronic high-magnification recorder to produce diagrams on a universal testing machine.

**9-177. Testing Motor Brushholder Springs.** *Steel*, v. 121, Dec. 1, 1947, p. 128.

Device developed by General Electric Co.

**9-178. Hardness Testing With a Ball Trace.** *Product Engineering*, v. 18, Dec. 1947, p. 124-126.

Construction and use of an instrument in which a ball is freely suspended and rolled at constant load over the specimen that moves on a slide beneath the ball at a specified velocity. Width and depth of the trace left by the ball on the specimen are used as an indication of Brinell hardness caused by cold rolling. The machine can also be used for testing variations in hardness as a function of time. (Translated and condensed from "Hardness Testing With a Ball Tracing Machine" by H. Hauttman, *Stahl und Eisen*, Sept. 2, 1943, p. 641.)

**9-179. Testing the Strength of Magnesium Die Castings.** Walter L. Fleischmann and George M. Stone, Jr. *Die Castings*, v. 5, Dec. 1947, p. 25-26, 40-42.

Physical properties of samples cut from castings produced by several die casters. Twenty magnesium castings were obtained from each of two sources making identical castings but different gating techniques, and 20 from a third foundry making a slightly different magnesium casting, but using the same gating technique as the first foundry. The test program was set up to show if any significant differences existed, first, between castings picked at random from one shipment; second, between sections within a casting; and, third, between castings produced by different die casters.

**9-180. Creep and Creep-Rupture Testing.** G. V. Smith, W. G. Benz, and R. F. Miller. *Steel*, v. 121, Dec. 8, 1947, p. 88-90, 106, 108.

Description of specimens, temperature controls, test stands, general procedures, and use of data. (Based on data presented at annual A.S.T.M. meeting, Atlantic City, N. J., June 1947.)

**9-181. Correlation of Tension Creep Test With Relaxation Tests.** *Journal of Applied Mechanics*, v. 14 (*Transactions A.S.M.E.*, v. 69), Dec. 1947, p. A352-A355.

G. W. Housner presents solutions for several differential equations used in above paper by E. P. Popov. C. R. Soderberg suggests a more fundamental approach to the relaxation problem. Author's replies.

**9-182. Methods Used in the Preparation of Test Specimens. (Concluded.)** G. L. Smith. *Sheet Metal Industries*, v. 24, Dec. 1947, p. 2444-2446, 2450.

Inspection of the test pieces.

**9-183. How Processing Affects Bolt Fatigue Strength.** N. B. Green. *Machine Design*, v. 19, Dec. 1947, p. 138-140.

Results of investigation of NAS high-strength steel bolts obtained by use of a hydraulic test machine designed to test three bolts simultaneously.

**For additional annotations indexed in other sections, see: 3-381; 8-178; 18-263; 22-757-758; 23-551; 24-403-415.**

## 10 ANALYSIS

**10-232. An Improved Spectrographic Source.** C. Braudo and H. R. Clayton. *Journal of the Society of Chemical Industry*, v. 66, Aug. 1947, p. 259-237.

A spectrographic source of stable characteristics. The circuit was tested by analyzing numerous samples of pure aluminum and an aluminum alloy. 35 ref.

**10-233. Hydrogen, Nitrogen and Oxygen in Ferrous Metals. Their Properties and Their Determination. Part I.** E. C. Pigott. *Metallurgia*, v. 36, Oct. 1947, p. 335-338; v. 37, Nov. 1947, p. 23-27.

A critical review.

**10-234. Investigations on Colorimetric Methods of Metallurgical Analysis. Part III. Permanent Standards for the Colorimetric Determination of Molybdenum in Alloy Steels.** G. V. L. N. Murty. *Metallurgia*, v. 36, Oct. 1947, p. 345-346.

The stability of the color involved in the visual colorimetric estimation of molybdenum in alloy steels cannot be increased beyond 8 hr. by modifications in procedure or addition of perchloric acid. Preparing duplicates of these colors by mixing solutions of inorganic substances. Satisfactory duplicates may be prepared from mixtures of potassium dichromate and cobalt nitrate solutions.

**10-235. The Determination of Zinc in Metallic Cobalt by Dithizone.** R. S. Young. *Metallurgia*, v. 36, Oct. 1947, p. 347-348.

A method claimed to have some advantages over conventional methods when small quantities are involved.

**10-236. Chips for Chemical Analysis.** C. O. Lundberg. *Metal Progress*, v. 52, Nov. 1947, p. 811.

Fine, short chips can be easily obtained by using an ordinary drill ground nearly flat.

**10-237. A Systematic Scheme for Identifying Corrosion Resistant Metals.** Chester J. Zeeh. *Metal Progress*, v. 52, Nov. 1947, p. 824, 824B, 825.

Qualitative analysis chart including use of electrographic tests. Construction of electrograph. Analysis scheme also includes other simple and rapid techniques, such as spot and magnetic testing.

**10-238. The Art of Carbometry.** F. S. Ellis and Horace Mac Lees. *Blast Furnace and Steel Plant*, v. 35, Nov. 1947, p. 1357-1358.

"Carbometry" is the determination of carbon in steel. Carbometers are electrical instruments which measure some property related to carbon content. Basic principles of good carbometry.

**10-239. Tin-Base Bearing Metals; Selected Methods of Chemical Analysis.** J. W. Price. *Metal Industry*, v. 71, Nov. 14, 1947, p. 399-400.

Scheme of analysis is based on selected methods in use at the Tin Research Institute for white-metal bearing alloys containing more than 80% tin.

**10-240. Qualitative Semimicro-Analysis With Reference to Noyes and Bray's System: Partial Analysis of the Combined Nickel, Zirconium, and Rare-Earth Groups.** Christina C. Miller. *Journal of the Chemical Society*, Oct. 1947, p. 1347-1350.

A scheme of analysis for the detection and approximate determination of 0.25 to 50 mg. of Mn, Co, or N; 0.25 to 10 mg. of Ti, Zr, In, Sc; and a small amount of Zn (minimum 0.25 mg.) in solutions containing a maximum of 50 mg. referred to the metals. These include all of the more important elements present in the combined nickel, zirconium, and rare-earth groups of Noyes and Bray's scheme.

**10-241. Spot Tests for the Detection of Alloying Elements in Tin-Base Alloys.** B. S. Evans and D. G. Higgs. *Analyst*, v. 72, Oct. 1947, p. 439-443.

Tests for lead, copper, arsenic, antimony, zinc, and aluminum.

**10-242. A System of Qualitative Analysis for the Common Metals in Presence of Phosphates, Using Ammonium Benzoate.** G. J. Austin. *Analyst*, v. 72, Oct. 1947, p. 443-446.

Modification of the benzoate iron-group separation in which the solution remains acid until all the metals except magnesium and alkali metals have been separated. This system of analysis can be applied regardless of the presence of phosphate.

**10-243. Spectrophotometric Determination of Iron in Ores With 2,2'-Bipyridyl.** J. P. Mehlig and M. J. Shepherd, Jr. *Chemist-Analyst*, v. 36, Nov. 1947, p. 52-55.

Method depends upon reducing the iron with hydroxylamine hydrochloride and measuring the light transmittancy at 522 mμ of the colored solution produced by 2,2'-bipyridyl within the pH range of 3 to 9. Results agree closely with those obtained by the dichromate titrimetric method. 13 ref.

**10-244. Analytical Application of Sodium Bis (2-Hydroxyethyl) Dithiocarbamate.** E. J. Serfass and W. S. Levine. *Chemist-Analyst*, v. 36, Nov. 1947, p. 55-57.

New modification of the dithizone method for determining zinc in nickel plating baths.

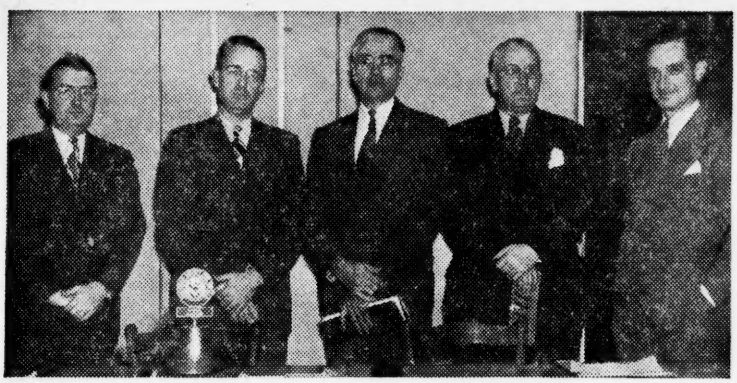
**10-245. Spot Test for the Detection of Cadmium in Plating on Metals.** Karl A. Jorczak. *Chemist-Analyst*, v. 36, Nov. 1947, p. 64.

Consists of cleaning with 20% HCl and adding a crystal of $Na_2S$. In presence of Cd, a yellow residue of CdS is formed.

**10-246. Determination of Phosphorus, Germanium, Silicon, and Arsenic by the Heteropoly Blue Method.** D. F. Boltz and M. G. Mellon. *Analytical Chemistry*, v. 19, Nov. 1947, p. 873-877.

*(Turn to page 20)*

## *Salt Bath Advantages Listed*



*At the Speakers' Table, Muncie Chapter. Are, Left to Right: Dallas F. Lunsford, Secretary-Treasurer; Walter F. McCormack, Chapter Chairman; H. J. Babcock of the Ajax Electric Co.. who spoke on "Salt Bath Heat Treatment"; Eugene E. Everett, Technical Chairman; and Ralph D. Hawkins, Sales Engineer, Ajax Electric Co. (Photo by Gene P. Davis)*

Reported by Gene P. Davis
*Metallurgist, Warner Gear Div. Borg-Warner Corp.*

Speaking on "Salt Bath Heat Treatment" before the Muncie Chapter at its November meeting, H. J. Babcock, research engineer for Ajax Electric Co., Inc., stressed the close temperature control possible by this method of heating. Mr. Babcock opened his talk with a short history of the development of the electrically heated salt bath.

Salt baths have three other inherent advantages, the speaker continued. First, they provide the simplest method of solving the atmosphere problem; second, heating is uniform within 5° F.; and third, heating is safe and rapid—approximately four to six times faster than other methods, Mr. Babcock stated.

He then discussed various applications of salt bath heat treatment, such as brazing, carburizing, wire tempering, hardening high speed steel, austempering, martempering and hardening from neutral baths.

## Hot Drawing Benefits Steel

Reported by W. E. Borin
*Metallurgist, Underwood Corp.*

Hartford Chapter ASM convened on Oct. 14 to hear L. E. Gippert, service metallurgical engineer of the Allegheny Ludlum Steel Corp., speak on "Hot Drawn High Speed Steel".

Introduced by Technical Chairman Erwin A. Sanford, Mr. Gippert described the advantages derived from hot drawing to small sizes in high speed drill rod. Hot drawing, which materially reduces the number of annealing cycles, results in smaller agglomerated carbides and possible higher secondary or temper hardness. Mr. Gippert stressed the point that along with lowered cost, better quality is obtained.

## Michigan Scholarship Founded

The Calumet and Hecla Consolidated Copper Co. has announced a four-year scholarship in either mining or metallurgical engineering at the Michigan College of Mining and Technology, Houghton, Mich.

The award will be made to a graduating senior selected from the high schools of Houghton and Keweenaw counties. The scholarship will cover all fees and all charges connected with the four-year course and will also pay to the student a small monthly sum.

## Fundamental Data on Corrosion Lacking

Reported by J. C. Selby
*Metallurgical Engineer Tinken Roller Bearing Co.*

Mars G. Fontana, professor of metallurgical research and also director of the corrosion research laboratory at Ohio State University, outlined some of the fundamental research he is presently directing, although his talk in the main was quite practical in nature. Dr. Fontana addressed the November meeting of the Canton-Massillon Chapter ASM.

After enumerating the eight forms of corrosion, he discussed various methods of combating them. A large number of excellent slides were projected to illustrate corrosion failures in plant equipment. These Dr. Fontana explained by pointing out the type of failure involved and discussing the corrective measure taken for each. Failures due to erosion-corrosion were emphasized, since this field is one of Dr. Fontana's major interests. Although confined for the most part to the stainless steels, several examples of nonferrous corrosion failures were illustrated.

Dr. Fontana closed his talk by pointing out the lack of fundamental information on corrosion—a knowledge of why and how corrosion occurs. He did, however, present the theory that the corrosion resistance of stainless materials may be due to surface adsorption of gases rather than the commonly accepted theory of an oxide film.


## READER SERVICE COUPON

*Check These Numbers for Production Information and Manufacturers' Catalogs. The following numbers refer to the new products listed in the article on "Products and Processes for Heat Treating" starting on page 13.*

**THIS COUPON IS VOID AFTER APRIL 1, 1948**

**Metals Review, January 1948**

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A study of the heteropoly blue method for phosphorus, germanium, silicon, and arsenic using a Beckman spectrophotometer. 31 ref.

**10-247. The Quantometer—A Tool for the Metallurgist.** Walter Bonsack. *Metal Progress*, v. 52, Dec. 1947, p. 975-978.

How a direct-reading spectrometer speeds the quantitative analysis of light-metal alloys for 20 individual elements. Light from a single selected spectral line from each element is absorbed by an individual photoelectric cell, and the current so generated is multiplied by electron tubes so that it drives a counter and indicates the result on a printed tape.

**10-248. Russian Methods for Spot Testing Steel.** *Iron Age*, v. 160, Dec. 18, 1947, p. 76.

Spot testing methods used by Russian chemist for Cr, Mo, Al, Ni, W, and Va.

**10-249. Quantometer Speeds Aluminum Alloy Analyses.** T. S. Blair. *Iron Age*, v. 160, Dec. 18, 1947, p. 65-67, 135.

Application of the Quantometer, a special direct-reading spectrometer, to the manufacture of aluminum casting alloys. It is capable of 5-min. analyses on a production basis. (Similar to "The Quantometer—A Tool for the Metallurgist", Walter Bonsack, *Metal Progress*, v. 52, Dec. 1947, p. 975-978.)

**10-250. More Time for Bath Alterations Provided by Use of Spectrograph in Steel Plants.** B. W. Bowen. *Steel*, v. 121, Dec. 29, 1947, p. 69-70, 72.

Instrument permits simultaneous determination of all elements on one sample, thus allowing more time for the melter to alter the furnace or ladle additions, or the sizes of molds into which the heat is to be poured. The technique is satisfactory for basic iron, openhearth slags, or fully killed, deep drawing steels. (Presented at the annual meeting of Southern Ohio Section, National Open Hearth Committee, A.I.M.E., Columbus, Ohio, Oct. 31, 1947.)

**For additional annotations indexed in other sections, see:**
11-213; 27-261-264.

## 11 INSTRUMENTS
## Laboratory Apparatus

**11-199. An X-Ray Method of Measuring Poisson's Ratio.** R. F. Hanstock and E. H. Lloyd. *Institution of Mechanical Engineers Proceedings*, v. 157, War Emergency Issue No. 26, 1947, p. 52-54; discussion, p. 55.

The specimen, which is a small tensile-test piece, is examined at various loads by a high-angle, "back-reflection", X-ray technique. Experimental results for the aluminum alloy Hiduminium RR.56. The method has the advantage of providing values which apply to a single set of crystallographic planes in a polycrystalline metal.

**11-200. Measurement of Thickness of Oxide Coatings on Aluminum Alloys.** Ralph B. Mason and William C. Cochran. *ASTM Bulletin*, Oct. 1947, p. 47-51.

Results using an electrical instrument known as the Filmeter compared with those obtained by the microscopic and the stripping methods.

**11-201. Logarithmic Scales of Odd Lengths.** *Metal Progress*, v. 52, Nov. 1947, p. 810-811.

How to use the sliding part of a slide rule to determine exact values from a logarithmic chart with comparatively large subdivisions.

**11-202. A Temporary Holder for Polishing Metal Specimens.** Henry Leidheiser, Jr. *Metal Progress*, v. 52, Nov. 1947, p. 811.

Plastic holder for thin specimens which must be polished on both sides.

**11-203. Adherence of Enamel.** Allen C. Francisco. *Metal Progress*, v. 52, Nov. 1947, p. 812.

Instrument developed at Bureau of Standards for testing adherence of enamel.

**11-204. The Heat and Mass Flow Analyzer—A Tool for Heat Research.** Victor Paschkis. *Metal Progress*, v. 52, Nov. 1947, p. 813-818.

Principles of a mathematical analyzer developed at Columbia University. Miscellaneous metallurgical problems including furnace construction, operation of controls, solidification of ingots and castings, and heating of masses of metal. Results in several cases have been satisfactorily verified both by direct experiment and by calculation. 35 ref.

**11-205. Mathematical Analyses of Metallurgical Data.** Michael G. Corson. *Metal Progress*, v. 52, Nov. 1947, p. 828-829.

Claims to present a more logical approach to the systematic evaluation of cooling time of Jominy bars to half-temperature than that presented by Liedholm in the Feb. issue.

**11-206. Width of Crack Discoverable by Deep Etching.** Russell H. Lauderdale. *Metal Progress*, v. 52, Nov. 1947, p. 830-831.

Two hardened toolsteel blocks were wrung and bolted together. Then several metallographic procedures were applied in order to reveal the crack between the two pieces. The usual technique (50% HCl at 170° F. for 45 min. plus 10 sec. in 10% Nital) showed no crack. Neither did wet magnafluxing. Macroetching in hot HCl revealed the joint.

**11-207. Porcelain Enamel Adherence Tester.** *Technical News Bulletin (National Bureau of Standards)*, v. 31, Nov. 1947, p. 130-131.

A new instrument based on completion of an electric circuit through the metal of the deformed specimen to a steel probe touching the test area. By using a large number of probes, and counting the number that conduct a current during the test, an estimate can be obtained of the area that has been exposed.

**11-208. A Modified Fitch Thermal Conductivity Apparatus.** Zaboj V. Harvalik. *Review of Scientific Instruments*, v. 18, Nov. 1947, p. 815-817.

An apparatus based upon increase of temperature of a receiver by heat transferred through the sample and its modification to samples inclined to the horizontal. Temperature changes of the receiver are measured with thermocouples.

**11-209. Divergent Beam X-Ray Photography of Metallic Single Crystals.** A. H. Geisler, J. K. Hill, and J. B. Newkirk. *Physical Review*, v. 72, Nov. 15, 1947, p. 983-984.

A new type of X-ray diffraction phenomenon observed in Laue patterns of certain alloys is similar to the Kikuchi lines which are found in electron-diffraction patterns of thick crystals. Such patterns can be used for determinations of crystal orientation and precise lattice constants and for an evaluation of the perfection of the crystal.

**11-210. Testing by Ultrasonics.** S. Young White. *Audio Engineering*, v. 31, Nov. 1947, p. 28-30, 39-40.

Three fundamental test methods are by reflection, by velocity, and by attenuation of the signal. How ultrasonics may be used to detect flaws in metals, measure temperatures of molten metal or glass, and to mix accurately gases and liquids in process controls.

**11-211. Deoxidation Control by Fractography.** G. C. Woodside. *Iron Age*, v. 160, Dec. 4, 1947, p. 78-79.

By fracturing brittle materials and examining an unpolished grain surface which lies at right angles to the objective, it is possible to observe more clearly any constituent, such as oxide or carbide, which may be present at the grain boundaries. This fractographic technique is used in the Climax Molybdenum laboratory in controlling deoxidation of arc melted and cast molybdenum ingots.

**11-212. The Determination of Tin Coating Weights on Tin-Plate.** Hugh A. McKenzie. *Journal of the Society of Chemical Industry*, v. 66, Sept. 1947, p. 312-319.

Methods for estimating weights by removing the tin coating quantitatively. The action of several stripping reagents on both hot-dipped and electrolytic tin-plates was studied by measuring weight losses and by metallographic examinations of the stripped specimens. Hydrochloric acid inhibited with antimony trichloride was the only reagent which completely removed the tin coating and the alloy layer from hot-dipped plates. Alkaline potassium iodate is a satisfactory alternative reagent for electrolytic plates. 30 ref.

**11-213. The Automatic Control of the Spectrographic Exposure.** C. H. R. Gentry, D. Newson, and D. F. Rushman. *Journal of the Society of Chemical Industry*, v. 66, Sept. 1947, p. 323-325.

An electronic circuit by which the necessary cycle of operations is automatically produced. By choosing suitable values of the components, a multiposition selectro switch enables a choice of pre-spark and exposure times to be made.

**11-214. New Applications of X-Ray and Electron Beams to Metal Research.** Ben H. Alexander. *Metal Progress*, v. 52, Dec. 1947, p. 989-990, 1024.

Reviews series of papers presented at Fifth Annual Conference on X-Ray and Electron Diffraction, Pittsburgh, Nov. 7-8, 1947.

**11-215. The Measurement of the Magnetic Properties of Fine Wire.** P. T. Hobson, E. S. Chatt, and W. P. Osmond. *Electronic Engineering*, v. 19, Dec. 1947, p. 383-388.

Apparatus for measurement of the remanence and coercivity of fine wires of diameter 0.004 in. with a maximum applied field of 1000 oersteds, and with maximum sensitivity to allow readings of remanence to be made as low as 100 gausses. Appendix on application of differential permeability curves to the magnetic analysis of alloys.

**11-216. Instruments and Their Applications as Reported in Recent Literature.** Orval L. Linebrink. *Metals Review*, v. 20, Dec. 1947, p. 5-7, 9.

Reviews the literature of 1946 and 1947 to date on the above subject with references to items in *Metals Review's* "Review of Current Metal Literature".

**11-217. Instrumentation.** *Metals Review*, v. 20, Dec. 1947, p. 11, 13, 15, 17, 19, 21.

Miscellaneous new equipment for

*(Turn to page 22)*

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# Understanding of Physics Dispels Mysticism of Heat Treatment, Says Clark

Reported by H. L. Millar

The so-called mysticism associated with heat treating would be dispelled if the physics of the process were understood, according to Donald S. Clark, associate professor of mechanical engineering, California Institute of Technology, speaking before the Los Angeles Chapter ASM.

Defining physics as the branch of science which deals with changes of physical characteristics without chemical change of the mass as a whole, Dr. Clark briefly discussed the results of thermal effects on alloys in general. The allotropic modifications of iron were reviewed by the speaker preliminary to a discussion of the changes which occur in steel under the influence of heat. Dr. Clark differentiated between alpha iron and ferrite (its solid solution with carbon) and gamma iron and austenite (also a solid solution). Occurring as they do at widely separated temperatures, these variables permit a wide range of properties in steel.

For simplicity of demonstration, Dr. Clark chose eutectoid steel and traced the phase changes on heating. Referring to the holding time or soaking period in heat treating to obtain a homogeneous solid solution of austenite, he listed the following factors which influence the transformation: *(a)* pearlite grain size, *(b)* rate of nucleation, *(c)* proper temperature, *(d)* presence of alloys, and—most important—*(e)* rate of growth of austenite grains, and *(f)* time at temperature to accomplish homogeneity within the newly formed austenite. Special emphasis was placed on this latter factor and warning issued to heat treaters that 4 hr. is required to produce homogeneous austenite.

Discussing the quenching operation, Dr. Clark referred to S-curves to review how transformation occurring above the knee of the curve always results in pearlite; immediately below the knee produces bainite (a supersaturated solution of iron carbide in alpha iron); or below 500° F. forms martensite (a supersaturated solution of iron carbide in body-centered tetragonal crystal structure). Tempering after hardening yields approximately the same products, he said.

The presence of alloys in the steel, the speaker continued, does not alter the mechanism of the physical changes which occur on heating or cooling, but it does alter the rate of change and the temperature at which they occur. These facts are used to advantage by the engineer when he designs parts with heavy or variable sections.

In conclusion, Dr. Clark referred to the strong alliance which exists between the physicist and the metallurgist and stressed the importance of physics in the solution of new heat treating problems.

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## Two Lectures Cover Castings

Reported by Henry Hauseman
*Metallurgist, LaPlant-Choate Mfg. Co.*

"Castings" formed the subject of two lectures on consecutive evenings that comprised the fall educational course of the Cedar Rapids Chapter. The first lecture, delivered on Dec. 11, was on "Cast Steels" and was presented by George Koch, chief inspector of Wehr Steel Co., Milwaukee. C. H. Stone of Belle City Malleable Iron Foundry, Racine, Wis., gave the second night's lecture under the title "Malleable and Gray Iron Castings".

# The Reviewing Stand

THE NEW YEAR—the time to take inventory, make resolutions, survey the past and forecast the future—is also for us the time to close the annual volume of the Review of Metal Literature and start a new one. The monthly issues for the year just completed are then assembled and reprinted in book form accompanied by a complete author and subject index.

The time-honored New Year survey of past deficiencies, the hopeful resolutions to correct these shortcomings, improve our ways and attain new virtues are applied to the Review of Metal Literature just as they are to our own frail consciences. Consequently, the February issue, which annotates articles published in January, will mark the beginning of an entirely new system of subdividing the 27 sections, along with certain revisions in the titles and content of the sections themselves.

Last October in this column we asked for opinions on the worth of the Materials Index, a feature carried since the beginning in 1944. (Since the 27 main classifications are by *process*, the Materials Index listed, by annotation number, the articles referring to a specific metal or its alloys.) Not many requests for continuation of the Materials Index were recorded, but those who want it were emphatic in saying so. The net result is a new system of classification that we are convinced will embody certain improvements and eliminate existing defects. Henceforth, each section will be subdivided into four classifications—*(a)* general, *(b)* ferrous, *(c)* nonferrous, and *(d)* light metals.

Advantages over the former Materials Index are that the articles are classified directly in the text without the necessity of referring to a long list of numbers at the back of the magazine; much time should be saved by the man who is looking for a specific article, as well as the man who wants general information on a certain process applied to a certain metal; welding of aluminum and magnesium, for example, would form almost the entire subject matter of Section 22d.

Another reason for breaking the sections into subdivisions is the tremendous increase in bulk during the past year—from an average of about 450 annotations per month to nearly 800! However, the new system will in no way serve as a substitute for the complete and thorough subject index that is standard equipment in the bound volume.

### Punch Card Filing

For the thorough reader and meticulous worker who wants his background information where he can put his fingers on it with least waste of time and temper, no classification or index is a substitute for an efficient filing system. Such a system for metallurgical literature (abundant, diverse and complex as it is) has been only a gleam in a researcher's eye until the idea was conceived of applying punch card methods to filing of technical data.

How simply the idea can be worked out and how well it is suited to filing of Metal Literature Review annotations (as well as the notes and references of all sorts often found heterogeneously lumped together in an engineer's notebook) is amply demonstrated by an article in the December issue of *Metal Progress*, page 993. And if you don't think metallurgical literature is abundant, diverse and complex, take a look at the table on pages 998 and 999! M.R.H.

metallurgical process control, with some notes on modern laboratory devices, as described by the manufacturers.

**11-218. Microradiography.** F. W. Von Batchelder and J. H. Schaum. *Iron Age*, v. 160, Dec. 11, 1947, p. 94-97.

Method of producing microradiographs. Microradiographs and photomicrographs of identical structures illustrate the basic differences between the two procedures.

**For additional annotations indexed in other sections, see: 3-396; 6-318; 27-279.**

## 12 INSPECTION AND STANDARDIZATION

**12-213. B.S. 970: (1947) Wrought Steels —EN Series.** *Engineering Materials and Processes*, v. 5, Oct. 1947, p. 145-146.

Specification changes since 1942.

**12-214. Estimated Properties of Common Compositions of Hot Rolled and Cold Drawn Carbon-Steel Bars.** *ASTM Bulletin*, Oct. 1947, p. 31-33.

Changes in specifications. A-107 and A-108. Data obtained during experimental work.

**12-215. Sensitometry of Radiographic Films Exposed to Two-Million-Volt X-Rays.** E. A. Burrill and W. W. Buechner. *ASTM Bulletin*, Oct. 1947, p. 52-57.

A study of eight commercial films results in charts that are useful for predicting radiographic exposures for any film density and speed and for any object thickness. They permit radiography of very heavy metal sections with confidence. (Presented at Annual Meeting of A.S.T.M., Atlantic City, N. J., June 16, 1947.)

**12-216. Zinc-Base Die Casting.** A. W. Sundwick. *Western Metals*, v. 5, Nov. 1947, p. 31-35.

Common surface defects.

**12-217. Hardenability Bands for H-Steels. Parts VII and VIII.** *American Machinist*, v. 91, Dec. 4, 1947, p. 135, 137.

Curves for H-steels from 8650H to 9445H.

**12-218. Can Hardenability Bands Be Narrower?** L. W. Cashdollar. *Metal Progress*, v. 52, Nov. 1947, p. 825-826.

Some calculations and charts indicate that narrowing of the bands would be desirable and probably feasible.

**12-219. Nondestructive Testing.** A. M. Armour. *Iron and Steel*, v. 20, Nov. 1947, p. 525-527.

New method for inspection of spot welds in stainless steels using captive-fluid detector cells and permanent magnets.

**12-220. The Fluoroscope as a Flaw Detector.** L. Sanderson. *Chemical Age*, v. 57, Nov. 1, 1947, p. 599-600.

An effective substitute for radiography.

**12-221. Automatic Gaging by Electronics.** *Western Machinery and Steel World*, v. 38, Nov. 1947, p. 90-91.

Use of instrument called the Limitron for gaging small precision parts.

**12-222. Multiple Correlation Applied to Steel Plant Problems.** W. T. Rogers. *Blast Furnace and Steel Plant*, v. 35, Nov. 1947, p. 1375-1376.

Condensed from paper presented to American Society for Metals, Chicago, Oct. 17-22, 1947.

**12-223. Some New Types of Slip Gages.** C. G. Greenham. *Engineering*, v. 164, Nov. 7, 1947, p. 436.

Four new types of slip gages designed in Australia. Two half-size gages, differing in size by the correct amount, are wrung on top of a suitable combination, so that the final combination can be used both as a "go" and a "no go" gage. (To be continued.)

**12-224. Design of an Ultrasonic Analyzer.** *Electronics*, v. 20, Dec. 1947, p. 102-105.

Equipment for nondestructive inspection of metal strip and production testing of uniform parts comprises a noise generator, transmitter, piezoelectric transducers, and a recording receiver. Flaw location can be automatically marked.

**12-225. Towards Quality Production.** D. R. Johnson. *Machinery Lloyd (Overseas Edition)*, v. 19, Nov. 8, 1947, p. 97-102.

The importance of inspection procedures for different production jobs.

**12-226. Precision Measurement. Section II—Instrument Inspection. Part 15—Measurement With Optical Flats: Inspection and Calibration of Gage Blocks. (Continued.)** Warren Baker. *Machine and Tool Blue Book*, v. 43, Dec. 1947, p. 198-200, 202-204, 206-209.

**12-227. Measuring With Air.** William Weeks. *Tool & Die Journal*, v. 13, Dec. 1947, p. 65-67, 120.

Use of constant-pressure air gages to measure critical dimensions of miscellaneous parts and products.

**12-228. 2,000,000-Volt X-Ray Installation.** Lovell Cardenas. *Iron and Steel Engineer*, v. 24, Dec. 1947, p. 89-96; discussion, p. 97-99.

Installation at Philadelphia; modern safety provisions.

**12-229. Vector Fields to Locate Deep-Seated Defects in Steel.** Robert M. Killen. *Materials & Methods*, v. 26, Dec. 1947, p. 66-67.

How magnetic powders are used to locate subsurface flaws in welds, sheet steel, and thin castings by use of superimposed electrical fields.

**12-230. Measuring Diameter of Fine Wire.** Robert W. Carson. *Wire and Wire Products*, v. 22, Dec. 1947, p. 967-971, 995, 996.

Advantages and limitations of various types of diameter-measuring instruments, with an analysis of the effect of anvil pressure on accuracy of measurement. (Prepared for Wire Association Annual Meeting, Oct. 22, 1947, Chicago.)

**12-231. Hydraulic-Electric System Expedites Inspection in Machine.** Walter E. Bock. *Machine Design*, v. 19, Dec. 1947, p. 107-111.

Automatic magnaflux machine and its use for inspection of crankshafts and camshafts.

**12-232. Purchased-Part Quality Controlled.** Ernest L. Fay. *American Machinist*, v. 91, Dec. 4, 1947, p. 98-100.

Application of statistical methods to inspection of incoming parts at John Deere Tractor Co.

**12-233. Clearances for Fine-Pitch Gears.** *American Machinist*, v. 91, Dec. 4, 1947, p. 149, 151.

Standard dimensions of tooth parts for 20°-pressure-angle, fine-pitch gears.

**12-234. X-Ray Inspection of Aluminum Jet Engine Castings.** W. A. Mader. *Iron Age*, v. 160, Dec. 11, 1947, p. 90-93.

Application of X-ray inspection methods and the benefits derived therefrom in the development of optimum casting procedures, as a guide in the repair of imperfect pieces, and in reducing machine-shop losses due to foundry defects to below 0.5%.

**12-235. Shadowgraph a Sample to Find Tool Errors.** C. H. Bodner. *American Machinist*, v. 91, Dec. 18, 1947, p. 87-90.

By machining a "section" of the piece, along with a trial lot, tool deficiencies can be found immediately by an optical-comparator method.

**For additional annotations indexed in other sections, see: 3-408; 22-759-763; 27-271.**

## 13 PYROMETRY Temperature Control

**13-61. The Ultimate Sensitivity of Radiation Detectors.** R. Clark Jones. *Journal of the Optical Society of America*, v. 37, Nov. 1947, p. 879-890.

A thermodynamical treatment of radiation detectors, including thermocouples, bolometers, and radiometers.

**13-62. Pyrometer for Measuring Temperature of Hot Gases.** *Industrial Heating*, v. 14, Dec. 1947, p. 2012.

New pyrometer developed at National Bureau of Standards.

**13-63. Remote Control of Continuous Slab Heating Furnaces.** C. E. Duffy. *Iron and Steel Engineer*, v. 24, Dec. 1947, p. 70-74; discussion, p. 74-75.

Control installation at Sparrows Point plant of Bethlehem Steel Co. for four 18x80-ft. triple-zone continuous slab-heating furnaces. (Presented at A.I.S.E. Annual Spring Conference, Philadelphia, May 26, 1947.)

**For additional annotations indexed in other sections, see: 11-216-217; 27-273.**

## 14 FOUNDRY PRACTICE

**14-340. Effect of Selenium Additions to Cast Steel.** T. N. Armstrong. *Electric Furnace Steel Conference Proceedings*, v. 4, 1947, p. 250-254; discussion, p. 254-257.

Laboratory and commercial results which indicate that selenium is capable of improving the ductility of steel castings.

**14-341. Controlled Pouring by the Wetherill Counter-Gravity Casting Process.** Roy D. Haworth and W. C. Wick. *Frontier*, v. 10, Sept. 1947, p. 3-6, 17.

The technique consists of sucking molten metal under controlled vacuum into the bottom of the mold without turbulence and without gas and dirt entrapment.

**14-342. Bronze Founding—A Review of Some Recent Developments.** Frank Hudson. *Metallurgia*, v. 36, Oct. 1947, p. 303-308.

Presented before Belgian foundrymen at Brussels. 15 ref.

**14-343. Preview of Elyria Alloy Foundry Held.** *American Foundryman*, v. 12, Nov. 1947, p. 48, 87.

Layout and equipment of new foundry of Electro-Alloys Division of American Brake Shoe Co.

**14-344. Aluminum and Magnesium Castings Impregnation.** E. V. Blackmun. *American Foundryman*, v. 12, Nov. 1947, p. 49-55; discussion, p. 55.

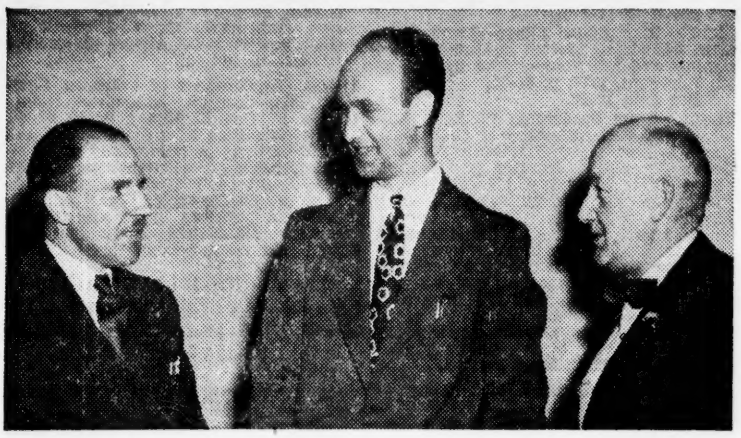
Recommended methods for leak testing of castings; types of impregnating materials and their properties; pressure-tight alloys; sodium silicate impregnation by immersion and by pressure; styrene-resin impregnation; the vacuum-pressure method; effects of cleaning, anodizing, painting, heat treating, and baking on the process and on product properties. 10 ref.

**14-345. 1947 Apprentice Contest; Pattern Division Entries Take Many Forms.** L. F. Tucker. *American Foundryman*, v. 12, Nov. 1947, p. 56-57.

Three prize-winning patterns for a specific molding job; three patterns which are considered impractical.

*(Turn to page 24)*

## *High-Temperature Behavior Explained*



*Left to Right at Boston Chapter Meeting Are William L. Badger, Technical Chairman; Nicholas J. Grant, Who Spoke on Behavior of Metals at Elevated Temperatures; and C. G. Lutts, Chapter Chairman*

Reported by W. L. Badger
*River Works, General Electric Co.*

Boston Chapter members were brought up to date in the rapidly developing field of "Behavior of Metals at Elevated Temperature", by N. J. Grant of Massachusetts Institute of Technology at the meeting on Nov. 7.

Dr. Grant pointed out the fallacy of high-temperature tensile tests and showed the role of the stress-rupture test which evaluates time and strain rate at temperature. The stress-rupture test also checks the stability of the alloy in the test atmosphere.

A double-log plot of stress versus rupture time was applied to copper alloys, low-carbon and low-alloy steels as well as the stainless and superalloys, and showed that brittle intercrystalline failures are normal behavior of metals at high temperatures. The effect of structural changes, such as spheroidization or graphitization, and of oxidation, corrosion and overaging were shown on the double-log rupture plots. These changes have the effect of making extrapolations of short-time data unreliable.

Finally Dr. Grant summed up those factors which promote high-temperature, high-stress application and those which retard it.

As coffee speaker, R. H. Markham outlined his interpretation of "The Balkan Situation". He spent many years in the Balkans as a *Christian Science Monitor* news correspondent until recently requested to leave by the authorities.

### *Ten-Year Book List To Start in February*

As a supplement to the "new book" section of the Review of Metal Literature, *Metals Review* will begin publication in the February issue of a ten-year list of books of interest to metallurgists, covering the period 1936-1947. The list has been compiled in the department of metallurgy at Massachusetts Institute of Technology.

The books will be listed according to subject matter and subdivided into 12 installments to be published in *Metals Review* during 1948. The entire list will then be reprinted as an appendix in the 1948 volume of the Review of Metal Literature.

## Specifications Provide Means of Lowering Costs

Reported by W. R. Jackson
*Carboloy Division, General Electric Co.*

"Material Specifications—a Criterion for Better Products at Lower Cost" was the subject presented by Gordon E. Willey, chief metallurgist of the Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont., to the Ontario Chapter on Nov. 7 in Toronto. Dr. Willey discussed material specifications with particular reference to the S.A.E. and A.I.S.I. standards.

Purchasing departments, said Dr. Willey, should be more familiar with the actual requirements and specifications and should furnish full details of the application to the mill. Closer liaison and cooperation between sales, purchasing and technical personnel of consumer and producer was urged. Dr. Willey stressed the fact that by such cooperation the costlier special steels could often be replaced with standard steels at lower cost to the consumer. Canadian economy and production could be helped by a program of standardization in all industries.

## Case Histories of Industrial Corrosion Point a Moral

Reported by R. P. Nevers
*Chemist, American Brass Co.*

Some case histories of industrial corrosion were cited by F. L. LaQue, who is in charge of corrosion engineering at the International Nickel Co., before an chapter meeting at New Haven, Conn. The moral of his address was to demonstrate the futility of generalizations concerning the corrosion resistance of a particular metal to a particular chemical or substance.

Mr. LaQue outlined the laboratory and field tests performed to solve a number of corrosion problems in industrial equipment. Seemingly minor variations in process conditions can alter the whole course and degree of corrosion, he pointed out.

In studying the corrosion of a dairy regenerator, test pieces were placed in various parts of the equipment and it was found that nickel was resistant to corrosion by milk when the heat was flowing from the nickel to the milk, but when flowing in the reverse direction, the nickel corroded. The direction of heat flow governed protective film formation.

A study of corrosion rate on nickel tubes in caustic soda evaporators showed that sulphur compounds in lower states of oxidation caused rapid corrosion, but when these were oxidized to sulphate, the corrosion rate was considerably reduced.

Certain machines containing monel metal parts used for dyeing silk stockings gave trouble and the difficulty was found to be in those machines equipped with tight-fitting doors. The dye in these machines tended to change color. Those machines with loose-fitting doors permitted the influx of sufficient air to keep the dye oxidized to true color.

In conclusion, Mr. LaQue emphasized that each phase of process or condition must be studied and the system adjusted, within process limitations, to minimize corrosion rate.

## Texas Devotes Meeting To European Problems

Reported by Harold W. Schmid
*Vice-President, General Metals Corp.*

A nontechnical meeting devoted to a discussion of current problems in Europe was held by the Texas Chapter in December. Prior to the introduction of the principal speaker, news editor Pat Flaherty of Houston Station KPRC presented last-minute coverage of European developments.

George E. B. Peddy, local attorney-at-law with a World War II background as a Military Government officer, then presented his subject, "What Shall We Do in Europe?" He left his audience with a realization of the importance of our international decisions.

**14-346. Melting High-Magnesium Aluminum-Base Alloys.** F. A. Allen. *Light Metals*, v. 10, Nov. 1947, p. 567-568.

Nature and properties of the structurally important, binary, aluminum casting alloys with high magnesium contents. Recommended melting practice compared with that required by normal aluminum alloys and by magnesium-base compositions.

**14-347. Water Power From Stainless Steel.** A. B. Jackson, III. *Western Metals*, v. 5, Nov. 1947, p. 20-21.

Production of turbines for hydroelectric plants by casting of stainless steel.

**14-348. Curious Wasters.** *Iron and Steel*, v. 20, Nov. 1947, p. 506.

Some unusual defects in castings.

**14-349. Electro-Alloys Foundry Equipped With Latest Type of Facilities.** *Blast Furnace and Steel Plant*, v. 35, Nov. 1947, p. 1361-1364.

Facilities, layout, and procedures of new high-alloy foundry.

**14-350. Causes of Die Casting Irregularities.** James L. Erickson. *Iron Age*, v. 160, Nov. 13, 1947, p. 82-87, 151; Nov. 20, 1947, p. 80-86.

Normal characteristics of die castings; effects of pressure, temperature, and design; irregularities affecting surface finish. Causes of some common die casting irregularities affecting dimensional tolerances, mechanical properties, and machinability.

**14-351. Why Cast Steel Centrifugally?** J. F. B. Jackson. *Iron Age*, v. 160, Nov. 27, 1947, p. 64-69.

Advantages and limitations from a British viewpoint; fields of application. It is thought in Britain that some American terminology is misleading. The role played by fluid pressure in producing sound, high-yield work.

**14-352. Cutting the Cost of Portable Tool Operations.** D. S. Linton. *Foundry*, v. 75, Dec. 1947, p. 84-87, 212, 214, 216.

Effects of low air pressures and how to correct them, including calculation of correct pipe sizes for the air lines. Determination of pressures close to the work with a hypodermic-needle pressure gage.

**14-353. Mold Strength.** Harry W. Dietert, H. H. Fairfield, and Edward Hasty. *Foundry*, v. 75, Dec. 1947, p. 94-95.

Mold strength is defined as the compressive strength of the sand at the face of a mold. How it can be measured with the mold-hardness tester; relationships of these values to dry and green compression strengths, and to permeability.

**14-354. Converts Dairy Into Modern Nonferrous Foundry.** Pat Dwyer. *Foundry*, v. 75, Dec. 1947, p. 90-93, 204, 206, 208, 210.

Procedures and equipment of Fischer Casting Co., N. Plainfield, N. J.

**14-355. Casting Artistic Bronzes. (Concluded.)** Pat Dwyer. *Foundry*, v. 75, Dec. 1947, p. 96-99, 125, 128.

Foundry practice at the Roman Bronze Works, Corona, L. I., N. Y.

**14-356. Casting a 14-Ft. Sheave.** *Foundry*, v. 75, Dec. 1947, p. 100.

Casting a 168-in., 19-groove, gray-iron Texrope sheave.

**14-357. Cereal Core Binders of Various Types Studied.** C. L. Mehltretter. *Foundry*, v. 75, Dec. 1947, p. 224, 226.

Green compression and baked tensile strengths of core-sand mixtures made with gelatinized wheat, rye and barley starches, and flours are compared with those obtained with a commercial binder of heat-gelatinized corn flour.

**14-358. The Foundry of Tomorrow Today.** C. B. Dick. *Scientific American*, v. 177, Dec. 1947, p. 252-254.

Improvements in foundry working conditions by purifying the atmosphere and by use of machinery to eliminate much heavy lifting.

**14-359. Precision Casting Small Aluminum Impellers.** Eugene M. Cramer. *Aluminium and the Non-Ferrous Review*, v. 12, July-Sept. 1947, p. 58-60.

See item 14-240.

**14-360. Magnesium Alloys—Small Calcium Additions.** Marvin E. Gantz. *Aluminium and the Non-Ferrous Review*, v. 12, July-Sept. 1947, p. 61-65.

See item 14-98.

**14-361. Mass Production Methods Applied to the Manufacture of Cast Steel Bomb Bodies.** Percy H. Wilson. *Foundry Trade Journal*, v. 83, Oct. 23, 1947, p. 149-155; Oct. 30, 1947, p. 177-180; Nov. 6, 1947, p. 197-203; Nov. 13, 1947, p. 219-221; discussion, p. 221-224.

The first instance of the successful production of steel in side-blown converters from metal consisting entirely of cupola-melted steel scrap. A highly mechanized steel foundry mass-produces 500-lb. bomb bodies in green sand molds, the various operations being integrated to give a steady production of 100 castings per hr.

**14-362. The Experimental Foundry at the Bureau of Mines.** J. E. Rehder. *Canadian Metals & Metallurgical Industries*, v. 10, Nov. 1947, p. 14-16.

Activities, types of work done, and policy of the foundry of the Canadian Bureau of Mines.

**14-363. Continuous Casting of Alloys Made Possible by New Process.** *Product Engineering*, v. 18, Dec. 1947, p. 148.

M. W. Kellogg Co.'s electric-ingot method for continuous metal casting. Alloying elements are continuously fed at a controlled rate into an electrical apparatus from which air is excluded, and in which an ingot of any desired analysis is produced by progressive solidification. Superiority and uniformity of properties are claimed.

**14-364. Factors Which Influence Surface Quality of Zinc-Base Die Castings.** A. W. Sundwick. *Machine and Tool Blue Book*, v. 43, Dec. 1947, p. 143-146, 148, 150-152, 154-155.

Causes of surface defects in die castings and methods of safeguarding against these defects.

**14-365. Electromagnetic Pumping of Molten Metals.** Mario Tama. *Iron Age*, v. 160, Dec. 4, 1947, p. 68-70.

A new, nonmechanical method for pumping molten metals of high melting point, used in conjunction with the induction melting furnace, appears to offer new and improved techniques for permanent mold and die-casting operations. Flow is controlled by variations of induced current, while volume of metal pumped is determined by duration and rate of discharge.

**14-366. Effect of Alloy Composition on Surface Quality of Die Castings.** A. W. Sundwick. *Iron Age*, v. 160, Dec. 4, 1947, p. 71-74.

Explains the value of close composition control by citing the influence of variations of the various elements on castability of the alloy. Fluidity and solidification-range tests used at General Motors Corp. as shop-control devices.

**14-367. Aluminum Alloy Castings.** Floyd A. Lewis. *Foundry*, v. 75, Dec. 1947, p. 74-77, 186-188, 190.

History of aluminum and the development of various alloy compositions. (To be continued.)

**14-368. Novel Toggle Mechanism Actuates, Locks Platen in Die Casting Machine.** *Machine Design*, v. 19, Dec. 1947, p. 153-154.

**14-369. Production Sand Casting.** Martin Schacht. *Western Machinery and Steel World*, v. 38, Dec. 1947, p. 80-82.

Methods and equipment used at Fresno Brass Works, Fresno, Calif.

**14-370. Machine Tools in Production Die Casting.** *Western Machinery and Steel World*, v. 38, Dec. 1947, p. 94-97.

Equipment and methods of Yoder Mfg. Co., Los Angeles.

**14-371. How to Make Die Castings.** James Van Voast. *American Machinist*, v. 91, Dec. 4, 1947, p. 103-118.

What is die casting? How die-casting machines work; die construction and operation; how to design dies; how to select alloys; die-casting production control.

**14-372. Applications of Precision Castings.** R. H. Osbrink. *Automotive Industries*, v. 97, Dec. 15, 1947, p. 38-40, 62, 64.

Potentialities of natural-bonded sand casting; precision sand casting—the Osbring process; synthetic-bonded, baked, precision sand casting; Anti-och or plaster-molded casting; the lost-wax process; permanent-mold casting; die casting; centrifugal casting; and vacuum-poured castings.

**For additional annotations indexed in other sections, see: 2-290; 9-179; 19-408; 23-472-502; 26-193-194-195; 27-275.**

## 15 SALVAGE AND SECONDARY METALS

**15-47. Single-Slag Heats.** M. J. Meinen. *Electric Furnace Steel Conference Proceedings*, v. 4, 1947, p. 109-110; discussion, p. 113-122.

Experience with 17 heats of S.A.E. 4140 steel using a charge of 50% heavy and 30% medium-heavy Cr-Mo scrap, and balance light plate scrap.

**15-48. Possibility of Use of Grinding Dust in Making Stainless Steel.** M. J. Meinen. *Electric Furnace Steel Conference Proceedings*, v. 4, 1947, p. 136-137.

Use of grinding dust in the electric furnace. Metallic recovery from this otherwise wasted material was about 70%.

**15-49. Metal Spray Practice in Steel Plants.** A. E. Cichelli. *Iron and Steel Engineer*, v. 24, Dec. 1947, p. 35-42; discussion, p. 43-47.

Procedures and applications in the repair of worn parts. (Presented at A.I.S.E. Philadelphia District Section Meeting, Feb. 1, 1947.)

**For additional annotations indexed in other sections, see: 2-293; 22-753-767; 26-195.**

## 16 FURNACES AND FUELS

**16-151. The Physics of Industrial Diathermy—Part 3.** A. W. Lay. *Electronic Engineering*, v. 19, Nov. 1947, p. 361-362, 364.

Analysis of application of high-frequency heating to industrial processes, including casehardening and tinning of steel plates.

**16-152. Study of Blast Furnace Downcomer Failures.** Charles M. Squarcy. *Blast Furnace and Steel Plant*, v. 35, Nov. 1947, p. 1353-1356, 1377.

Abstract from similar article in *Steel*. (See item 16-155.)

**16-153. Immersion Heating: Part I.** Maurice J. Dewey. *Industrial Heating*, v. 14, Nov. 1947, p. 1822, 1824, 1826, 1828, 1830, 1932.

History of the development of immersion gas heating; several new practical applications of process. (Presented at Industrial Gas School, Columbus, Ohio, sponsored by American Gas Assoc.)

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# High Speed Vs. Carbide Tools Are Debated

Reported by John W. Watson
*Metallurgist, Link-Belt Co.*

"High Speed Tools Vs. Carbide Tools" was the subject of a panel discussion before the Indianapolis Chapter at the November meeting. Walter Schlegel of Carpenter Steel Co. aptly explained the quality control and selection of high speed tools. Harry Crump of the Carboloy Co. then told when the use of carbide tools is preferable. Each speaker made concessions to the other's product and general agreement was reached.

Mr. Schlegel stressed the fact that the investigator must have a well-designed tool, properly heat treated and ground, before making any comparison. He warned that tools deserve the consideration of proper speeds and feeds. If the cutting edge exceeds 300° F. in use, and does not exceed 1200° F., it is probable that the choice of high speed steel is wise. If cutting edge exceeds 1200° F., as indicated by burning of the edge, the trial of a carbide tool is recommended. Mr. Schlegel made plain that tests under operating conditions are necessary to choose the right tool material.

Several treatments are of value for certain high speed tools, such as sub-zero treatment, chromium plating, oxide coating, liquid honing, and nitriding.

Mr. Schlegel believes that high speed steel is here to stay for a majority of applications. Tools can be used with maximum efficiency only through intelligent preparation, application and use. In machining steels of over 350 Brinell, Mr. Schlegel admitted that carbides should be used if possible, since high speed does not stand up well in this type of service.

Mr. Crump pointed out that we need not be too concerned over the multiplicity of carbide grades, for of approximately 15 types on the market, the majority of machining operations are performed with only five of these grades. The "straight" tungsten carbides (with suitable binders such as cobalt or nickel) are generally used on cast iron, nonferrous metals, and nonmetallics. For cutting steel, other carbides such as tantalum carbide and titanium carbide are added to the tungsten carbide in relatively small amounts to provide certain desirable characteristics.

Essentially the amount of binder—such as colbalt—determines the toughness and hardness of the carbide. A carbide containing 3% cobalt is very hard and relatively brittle. One containing 13% cobalt is softer and tougher. These represent the extremes of composition range usually employed.

The necessity of supported tool design and of properly attached carbide tips was emphasized. Carbides are recommended for high spindle speeds and light cuts. They are recommended and adaptable for turning, boring and facing of ferrous and nonferrous metals, plastics and wood. Heavy machines with adequate power, capable of high speeds and feeds, are necessary to realize the full potentiality of the material. However, a large number of manufacturers use carbides with good efficiency on machines that have a limited amount of power and may be of considerable age. Under such conditions particular attention is given to taking up the slack in the ways and slides and also reworking the spindle bearings for greater rigidity and smoother running. Greater accuracy of finished part and phenomenal tool life are often achieved by using the right carbide in the right way.

The operations of drilling, tapping, threading and cut-off are not always successfully performed by carbides, but on applications where machine conditions are capable of suitable speeds, feeds and adequate power, these applications are successful, according to Mr. Crump.

## *Dayton Chapter Congratulates Members*

*Fritz V. Lenel (Extreme Right) Is Bade Farewell at His Last Meeting in Dayton Before Going to Troy, N. Y., as Assistant Professor of Metallurgical Engineering at Rensselaer Polytechnic Institute. For the past ten years Dr. Lenel has been metallurgist with Moraine Products Division of General Motors Corp., and this year was a member of the executive committee of the Dayton Chapter. From left to right in the photograph are Jay Burns, James Poynter, Stewart DePoy, chapter chairman; and D. Hastie, the speaker. Messrs. Burns and Poynter were congratulated on their presentation of technical papers at the A.S.M. meeting during the National Metal Exposition in October*

# Names Five Elements Governing Performance Of Grinding Wheels

Reported by H. J. Reindl
*Metallurgist, Inland Mfg. Division, G.M.C.*

History, modern developments and applications of manufactured and natural abrasive products were presented by D. Hastie of the Carborundum Co. to the Dayton Chapter ❸. The performance of grinding wheels is dependent upon the following elements, Mr. Hastie said:

1. Abrasive grain. This element does the job of cutting.
2. Bonding material. This element acts as a binder and holds the abrasive grain in the form of a wheel.
3. Grade. This element is a measure of the strength with which the bonding material holds abrasive grain particles in the form of a wheel.
4. Structure. Grinding wheels may be manufactured in a variety of grain spacings from "open" having greater voids, to "dense" where the grain is more closely spaced and the voids are smaller.
5. The type and condition of the grinding machine.

Following the lecture a movie entitled "The Romance of Industry" gave a complete history of the production of manufactured abrasives from the discovery of silicon carbide in 1891 by the late Dr. Acheson to the present time. Climaxing the program, Mr. Hastie gave a special discussion on grinding of heat treated parts.

## O.S.U. Gives Welding Degree

A department of welding engineering to be established at Ohio State University will be the first of its kind in the nation.

In the College of Engineering at the university, the new department will offer undergraduate work leading to the degree of Bachelor of Welding Engineering and advanced study for graduate engineers. A pioneer in the field of welding engineering, Ohio State's College of Engineering has offered a curriculum in this field for some nine years, as a division of the department of industrial engineering.

**16-154. Induction Heating Desolders Gas Meters.** *Industrial Heating*, v. 14, Nov. 1947, p. 1854, 1856.

Use of induction heating in maintenance or servicing of gas meters.

**16-155. Investigation of Blast Furnace Downcomer Failures.** Charles M. Squarcy. *Steel*, v. 121, Nov. 24, 1947, p. 110, 112, 115, 116.

Study of dirty gas main conditions shows that mains which are too small permit erosion; those too large allow buildup which causes obstructions. Results of survey of conditions at various plants in Chicago area. (From paper presented at joint meeting of Blast Furnace and Coke Assoc. of Chicago and Eastern States Blast Furnace and Coke Oven Assoc., Cleveland, Oct. 10, 1947.)

**16-156. Steel Processing Furnaces.** Edmund B. Neil. *Steel Processing*, v. 33, Nov. 1947, p. 696-702c.

The contruction, operation, and applications of various types of controlled-atmosphere furnaces.

**16-157. Some Features of Openhearth Furnace Design. Part III.** G. Reginald Bashforth. *British Steelmaker*, v. 13, Nov. 1947, p. 554-563.

Design of slag pockets; furnace flues; reversing valves; furnace chimney and chimney flues; waste-heat boilers; and insulation. (To be continued.)

**16-158. Fundamentals of Openhearth Checkerwork Design.** Horace W. Potter. *Steel*, v. 121, Dec. 8, 1947, p. 112, 114, 116, 118, 120.

Presented at Eastern Section Meeting, National Open Hearth Committee, A.I.M.E., Philadelphia, Oct. 17, 1947.

**16-159. Anthracite as Cupola Fuel.** C. C. Wright. *American Foundryman*, v. 12, Nov. 1947, p. 40-47.

Paper presented before Fifth Annual Anthracite Conference, Bethlehem, Pa., May 8, 1947. (To be continued.)

**16-160. Carnegie-Illinois Builds Two New 1500-Ton Blast Furnaces.** *Iron and Steel Engineer*, v. 24, Dec. 1947, p. 100-105.

Recent figures on above furnaces; detail drawings.

**16-161. The Redesign of a Direct-Fired Air Heater.** R. M. Rush, H. A. Pietsch, and D. H. Marlin. *Iron and Steel Engineer*, v. 24, Dec. 1947, p. 105-108.

Possible uses for welded stainless steel assemblies in furnace design.

**16-162. A New Batch-Type Gas Cyaniding Furnace.** J. A. Dow. *Metal Progress*, v. 52, Dec. 1947, p. 984-987.

Advantages of the continuous gas-cyaniding furnace, at lower equipment cost, are secured in a batch-type furnace with work contained in shallow boxes charged and discharged through a vestibule at one end. The cold charge is heated by an interchange of heat with an "accumulator" built into the furnace walls. The gas atmosphere is continuously adjusted to the work temperature by an arrangement of catalyst tubes, and there is a special oil-quenching setup.

**16-163. Direct Heat Resistance Electric Furnaces.** Victor Paschkis. *Industrial Heating*, v. 14, Dec. 1947, p. 2002, 2004, 2006.

**16-164. Steel Laminations Annealed in Electrically Heated Elevator Furnace.** *Industrial Heating*, v. 14, Dec. 1947, p. 2008, 2010.

Electrically-heated, 180-kw., 208-volt, 3-phase, high-temperature, elevator furnace for annealing punchings of magnetic material in a hydrogen or nitrogen atmosphere up to a maximum temperature of 2150° F.

**16-165. The Design of Industrial Ovens With Special Reference to Safety. Part II.** C. A. Litzler. *Industrial Heating*, v. 14, Dec. 1947, p. 2043, 2046, 2048, 2050, 2052.

Points of incipient danger in any oven installation and precautions to be taken for the prevention of accidents. (To be continued.)

**16-166. Electric Furnace Brazing for Mass Production.** Henry Eickelberg. *Iron Age*, v. 160, Dec. 18, 1947, p. 56-59.

Utilization of a continuous, controlled-atmosphere, electric furnace for copper brazing, silver soldering, and bright annealing of a variety of products. Flexibility of the furnace is indicated by illustrations of a variety of sizes and shapes of parts produced, varying from a fraction of an ounce to several pounds in weight.

**For additional annotations indexed in other sections, see: 2-278.**

## 17 REFRACTORIES Furnace Materials

**17-99. Carbon and Graphite Electric-Furnace Electrodes.** T. L. Nelson. *Electric Furnace Steel Conference Proceedings*, v. 4, 1947, p. 5-12; discussion, p. 12-13.

Factors in choosing and handling of electrodes; recent advances in electrode joints.

**17-100. The Manufacture of Refractories and Information Concerning Their Use in the Iron and Steel Industry of Western Germany. (Continued.)** *Refractories Journal*, v. 23, Oct. 1947, p. 376-380.

Description of Bochumer Verein Gusstahlfabrikahon A. G. including personnel, general equipment, and blast furnaces. The metal mixers. (To be continued.)

**17-101. Structural Design of Refractory and Heat-Resistant Concrete. Part III: Practical Industrial Applications. (Concluded.)** *Industrial Heating*, v. 14, Nov. 1947, p. 1892, 1894, 1896, 1898, 1900, 1902-1903.

Application of ducts, flues, and stacks; stack linings; combustion-chamber arches; in the byproduct coke-plant; and miscellaneous coke-plant maintenance uses.

**17-102. Design of Carbon Hearths and the Results Obtained at the Carrie Furnace.** C. J. Fleisch. *Blast Furnace and Steel Plant*, v. 35, Nov. 1947, p. 1359-1360.

See item 17-104.

**17-103. Carbon Hearth Installations at Homestead.** C. J. Fleisch. *Iron and Steel Engineer*, v. 24, Nov. 1947, p. 93-96.

See item 17-104.

**17-104. Progress Report on Blast Furnace Carbon Hearths.** C. J. Fleisch. *Steel*, v. 121, Nov. 17, 1947, p. 116, 118.

Results at Carnegie-Illinois Steel Corp. show that new design of tapping hole affords increased strength and large variation in drilling angle. Carbon-hearth furnaces give more uniform size of casts and respond within two to four casts after a bank to provide suitable hot metal for the openhearth. (Presented at meeting of Blast Furnace and Coke Oven Assoc., Cleveland, Oct. 10, 1947.)

**17-105. Carbon Mold Plugs in Alloy Steel Production.** Harry F. Vollather. *Iron Age*, v. 160, Nov. 27, 1947, p. 70-73.

Use of 45,000 carbon mold plugs in the production of large alloy-steel ingots. Advantages are: lengthened mold life, absence of spalling, elimination of refractory inclusions, avoidance of soaking-pit contamination, and minimizing of leakage and other pouring difficulties. A comparison of carbon pickup of carbon and ceramic plugs.

**17-106. Refractories and Forging Costs.** H. J. Shaner. *Industrial Gas*, v. 26, Dec. 1947, p. 14, 30.

Refractories used in the lining of forging furnaces and their effect on forging costs.

**17-107. Iron Oxide Conversion, a Previously Unrecognized Cause of Refractories Destruction.** C. Burton Clark and C. L. Thompson. *Industrial Heating*, v. 14, Dec. 1947, p. 2056, 2058, 2060, 2064.

Laboratory experiments have shown that repeated alternate oxidizing and reducing conditions of 2200 and 2400° F., as well as repeated changes in temperature above and below 2500° F. in an atmosphere of air, cause a spongy growth in iron oxide. This growth is apparently the result of repeated conversions of one oxide to another, and may have a destructive effect where iron oxide is deposited on furnace refractories. (Condensed from paper presented at 49th Annual Meeting of American Ceramic Society, Atlantic City, N. J.)

**17-108. Carbon Hearths for Blast Furnaces.** *Iron Age*, v. 160, Dec. 18, 1947, p. 72-76.

Construction details of five carbon-block blast furnace hearths, together with some notes on operating experience with carbon linings.

## 18 HEAT TREATMENT

**18-246. Some Observations on the Occurrence of the "Grain Boundary Gamma" Phase in a 2% Beryllium, 0.25% Cobalt Copper Alloy.** P. J. E. Forsyth. *Metallurgia*, v. 36, Oct. 1947, p. 309-312.

Specimens in the annealed and half-hard condition were subjected to various solution heat treatment and tempering treatments. Quenching tests were then made to determine the effect of the quenching rate on the amount of grain boundary precipitate. Results of microscopic examination.

**18-247. The Heat Treatment of Steels Without Decarburization.** R. A. P. Misra. *Metallurgia*, v. 36, Oct. 1947, p. 327-330.

A new apparatus for producing and maintaining a suitable heat treating atmosphere. The equipment described burns paraffin or kerosene. Typical results on a number of steels.

**18-248. Heat Treating; a Cooperative Endeavor.** Keith F. Finlay. *Western Machinery and Steel World*, v. 38, Nov. 1947, p. 84-86.

Procedures adopted for coordination between design and heat treating departments at Northrop Aircraft.

**18-249. Continuous Versus Batch Annealing of Sheet and Strip.** T. F. Olt. *Iron and Steel Engineer*, v. 24, Nov. 1947, p. 52-62; discussion, p. 62-64.

Factors from the quality, economic, and production standpoint that govern the particular method of annealing for various grades of sheet and strip. Even with the most modern equipment, fuel and labor costs for normalizing exceed those of box annealing. (Presented before A.I.S.E. Pittsburgh District Section Meeting, March 10, 1947.)

**18-250. Practical Heat Treatment.** Henry Pfahl and G. D. Rahrer. *Western Metals*, v. 5, Nov. 1947, p. 24-23.

Normalizing; annealing; quenching and tempering; austempering; and martempering as applied to steel.

**18-251. Approximate Relationship Between Case Depth and Rockwell Hardness.** B. R. Payne, Jr., and L. S. Stutts. *Western Metals*, v. 5, Nov. 1947, p. 29-30.

Experimental investigation gave an accuracy of 0.002 in. in case-depth measurement, which is sufficient for most commercial applications. Material tested was steel containing 0.20% C, 0.94% Mn, 0.018% P, and 0.027% S.

*(Turn to page 28)*

# *Transportation, Architecture and Paper Industries Use Canadian Aluminum*

Reported by F. G. Wayman

*Assistant Superintendent of Wire Mill*
*The Steel Co. of Canada, Ltd.*

Use of aluminum in Canada today has expanded to more than five times the best prewar year, G. R. Black, manager, sales development division, Aluminium Co. of Canada, Ltd., told the Montreal Chapter on Nov. 3.

Prior to the war aluminum was used in Canada in small quantities in a relatively specialized field. The items of cooking utensils, seals and foil wrappings, electrical transmission cable, automotive pistons and cylinder heads, washing machine agitators and die-cast meter bases accounted for the major tonnages.

During the war extensive additions were made in the aluminum fabricating capacity in all types of products. While the greatest wartime use was for military aircraft, other less publicized items, such as fuse caps for anti-aircraft shells, powder for explosives, foil for interference of radio detection and radio and electrical equipment, consumed large quantities.

In the conversion to postwar uses, certain basic changes have been made in the alloys employed. Workhardened alloys common before the war are still used extensively, but in the field of heat treated alloys the emphasis has changed from the duralumin type containing copper and magnesium as the main alloying constituents to alloys employing magnesium silicide as the hardening constituent. The two outstanding examples of this class of alloy are 50S and 65S.

New developments in uses of aluminum cover nearly every phase of industry. Outstanding marine developments are in superstructures and lifeboats. The first superstructure built in Canada was the S. S. Redfern, completed in 1946. Aluminum railway equipment includes nearly every form of rolling stock from locomotive cabs and boxcars to passenger cars. Buses and trucks are typical examples of automotive transportation.

The field of architectural uses, under active development for many years, has broadened considerably and is illustrated in the use of extruded members as a facing material in place of stone, in the form of store front finishes and in miscellaneous applications such as windows, window sills, doors, partitions and roofing and siding.

Many new applications, naturally, have been developed in one of Canada's major industries—pulp and paper manufacture. These uses are based on the ability of aluminum to resist the action of mild sulphurous fumes and the reduced labor in handling light aluminum parts. Mr. Black mentioned core winder shafts, flake drier panels, sector frames, logging flumes, paper machine hoods and various types of rolls as examples.

Some of the more interesting miscellaneous developments include the use of aluminum tubing in irrigation lines, in rigid conduit and in various types of furniture, while two sheet products are well illustrated in domestic hot water tanks and washing machine tubs.

## Horger Speaks on Design

Reported by Melvin R. Meyerson

*National Bureau of Standards*

Too often metallurgists and designers have confirmed opinions in their respective fields which conflict with their ability to work together, O. J. Horger, chief engineer, railway division, Timken Roller Bearing Co., told the Washington Chapter at its meeting on Nov. 10. He spoke on "Relationship of Metallurgy and Design".

There is need in industry for men who are willing to work along combined lines, and Dr. Horger developed this theme by showing the relationships between metallurgical and design factors in preventing fatigue failures. Details of his talk have been previously reported in *Metals Review*.

## Charter Presentation and Foundry Night at Akron

Reported by Jack W. Hobbs

*Akron Welding and Spring Co.*

Charter presentation of the new Akron Chapter took place on Nov. 12, when National Secretary W. H. Eisenman presented the chapter charter to Chairman Christopher Floyd of Babcock and Wilcox Co. This event followed an earlier meeting in October, when National Trustee Arthur E. Focke spoke on "The Metallurgist, the A.S.M. and Industry".

The second part of the November meeting was foundrymen's night, with a talk presented by John N. Ludwig, Jr., of Electro Metallurgical Co., on "The Uses of Ferro-Alloys in the Production of Iron and Steel Castings". Among the many points of interest he touched upon were the addition of SMZ inoculant to cast-iron taps to produce iron of superior physical properties; use of chromium in ferrous alloy castings for corrosion and wear resistance and for service at elevated temperatures; the graphitization and consequent deterioration of carbon-molybdenum steel used in steam lines operating at 925 to 1000° F. Recent investigations indicate that the use of aluminum as a deoxidizer is basically the cause of this deterioration, he pointed out. It can be counteracted by additions of chromium as a stabilizer.

Discussion of the talk centered about improving physical properties of castings by adding silicon, molybdenum, chromium, sulphur, nickel and SMZ alloy—the latter a zirconium-manganese-silicon-base iron inoculant.

# Hot Workability Test Qualifies Steels for Seamless Tubing

Reported by G. L. Hershey

*Inspector, The Coleman Co., Inc.*

Cast iron pipe, which had its origin in 1906, was one of the early forms of metal tubing, Harry K. Ihrig, director of laboratories, Globe Steel Tubes Co., told the Wichita Chapter on Nov. 20 in a short historical introduction to his address on seamless tubing. About 200 years later the first seamless tubing was produced in England, but it was not until the rotary piercer was invented in Germany that seamless tubing became well known.

*H. K. Ihrig*

Dr. Ihrig then described the modern method of piercing and rolling hot finished tubing. A rotary furnace, 45 ft. in diameter, which is used for heating billets for the piercing operation, was illustrated. He explained that the very fact that a piece of seamless steel tubing exists is proof that it is made of excellent quality steel, for poor material would be unable to stand the drastic working received during the process.

The most important quality that the material must possess is good hot workability. A test for this has been devised in which a bar ⅞ in. in diameter is heated in a small furnace and then twisted. The number of turns before rupture indicates the degree of hot workability.

Hot finished tubing is available in diameters of 2½ in. and larger, but the smaller sizes must be made by cold drawing. Dr. Ihrig explained the drawing process with particular emphasis on stainless tubing, which is very difficult. A new patented lubricant has been developed at Globe Steel Tubes Co. It consists of an adhesive with small solid particles in suspension and has proved very satisfactory.

An interesting specimen of a small seamless tube such as used in hypodermic needles was exhibited.

## New Vice-Chairman Appointed

Dana W. Smith, first vice-chairman of the Baltimore Chapter, has resigned from Glenn L. Martin Co. to take a position as chief metallurgist in the research department, fabricating division of the Permanente Metals Corp., Spokane, Wash.

The Nominating Committee of the Baltimore Chapter has therefore appointed Thomas L. Moore, manager of western sales for Rustless Iron and Steel Division, as first vice-chairman. C. T. Scott has been named second vice-chairman, and J. C. Barrett chairman of the membership committee.

**18-252. New Fields for Prepared Atmospheres.** W. A. Darrah. *Industrial Heating*, v. 14, Nov. 1947, p. 1832, 1834, 1836, 1838, 1840, 1842, 1939.

Condensed from paper presented at recent Conference on Industrial and Commercial Gas, of American Gas Assoc. Boston.

**18-253. Facilities for Handling Variety of Parts Features Production Heat Treating at Atwood Vacuum Machine Co.** Louis C. Smith. *Industrial Heating*, v. 14, Nov. 1947, p. 1844, 1846, 1848, 1850, 1852, 1862.

**18-254. Lakeside Steel Improvement Co. Has Complete Heat Treating Facilities.** *Industrial Heating*, v. 14, Nov. 1947, p. 1905-1906, 1908, 1910, 1912.

To be continued.

**18-255. Selective Annealing of Nonferrous Metals.** L. H. Seabright. *Metal Progress*, v. 52, Nov. 1947, p. 811-812.

Use of annealing curves for heat treatment when material with the specified heat treatment was not available.

**18-256. Coalescing Anneals.** Albert M. Portevin. *Metal Progress*, v. 52, Nov. 1947, p. 829-830.

The physical principles underlying spheroidization of medium and high-carbon steels. Recommends use of an "oscillating anneal" in which temperatures fluctuate about the Ac, point.

**18-257. Creep in Hot Valve Springs.** Alberto Oreffice. *Metal Progress*, v. 52, Nov 1947, p. 832.

A few additional data which show value of austempering 0.48% C, 1.20% Cr, 0.15% V steel for this use.

**18-258. Advantages and Applications of Carbon Restoration.** O. E. Cullen. *Steel*, v. 121, Nov. 17, 1947, p. 94-95, 121-122.

By setting up an exact carbon balance between furnace atmosphere and original carbon in the steel, the gaseous process described removes undesirable inverse gradient of carbon. Treatment may be applied at almost any stage during conversion of original billet into finished product.

**18-259. Controlled Vacuum Heat Treating.** *Steel*, v. 121, Nov. 24, 1947, p. 80-83, 96, 99-100, 107.

Results of research on steel, while positive in nature, do not apparently lead to any new commercial processes. Small quantities of absorbed gases do have deleterious effects upon properties of metal, but such effects are rather small.

**18-260. Isothermal Heat Treatment Aids Bearing Production.** Paul A. Cushman. *Iron Age*, v. 160, Nov. 27, 1947, p. 76-77.

Utilization of isothermal salt bath heat treating has resulted in decreased processing time, less distortion and brittleness, and increased uniformity of hardness. Equipment and materials used and heat treating cycles followed.

**18-261. The Pins Had Slotted Ends.** *Welding Engineer*, v. 32, Dec. 1947, p. 41.

Surface hardening of caster pins for heavy-duty tractors proved to be difficult because of shrinkage of the slots. The problem was solved by pressing mandrels into the ends of the pins to expand their openings to compensate for the inevitable shrinkage, and by use of the progressive-spinning method of flame hardening.

**18-262. A Study of the Metallurgical Characteristics of Three Induction Hardened Steels Heated at Various Rates.** James W. Poynter. *Technical Data Digest*, v. 12, Dec. 1, 1947, p. 13-22.

See item 18-173.

**18-263. How Low Temperature Treatments Affect Properties of Steel.** H. W. Gillett. *Product Engineering*, v. 18, Dec. 1947, p. 81-84.

Use of cold treatment to accelerate or to cause continuation of metallurgical reactions; the various phenomena which take place explained in terms of the phase transitions which occur. Low-temperature notched-bar strengths at various temperatures down to −80° F. are charted for a quenched and tempered, rolled, Mn-Mo steel. A further use of cooling is to permit tests at the lowest service temperatures to be encountered. Such tests and their uses.

**18-264. Annealing for Stress Relief.** N. F. Ritchey and P. A. Berghorn. *Die Castings*, v. 5, Dec. 1947, p. 28, 43-45.

Effects of annealing of aluminum die castings upon dimensional stability and machinability.

**18-265. City Gas Atmosphere Used to Bright Anneal Copper Tubing.** Arthur Q. Smith. *Industrial Gas*, v. 26, Dec. 1947, p. 8-9.

**18-266. Automatic Handling for Induction Hardening.** G. P. Cardwell. *American Machinist*, v. 91, Dec. 18, 1947, p. 91.

How induction hardening apparatus combined with automatic handling equipment reduces production costs.

**18-267. Flame Hardening of Armor Plate.** E. L. Bartholomew, Jr., M. S. Burton, and F. R. Evans. *Metal Progress*, v. 52, Dec. 1947, p. 979-983.

Flame hardening of low-alloy armor plate by successive passes of a torch 6 in. wide was found to produce a hardened case, uniformly 0.25 to 0.30 in. deep. Surface hardness on 0.24 to 0.31% carbon plates was 510 Vickers. However, there was always a soft line where successive passes of the heating torch overlapped. A further difficulty in thin plate was excessive warpage. Subsequent straightening was likely to crack the plate. Methods utilized to remedy these drawbacks.

**18-268. Protective Coatings.** Robert B. Grossman. *Industrial Gas*, v. 26, Dec. 1947, p. 12.

An evaluation of seven commercial coating materials used to prevent oxidation or decarburization of steel surfaces during heat treatment. (From "Information Letter" prepared by Committee on Heat Treating and Finishing With Gas of the Industrial and Commercial Gas Section of the American Gas Assoc.)

**18-269. Continuous Scale-Free Heat Treatment of Curtiss Electric Propeller Hubs. Part II.** *Industrial Heating*, v. 14, Dec. 1947, p. 1982, 1984, 1986, 1988, 1990.

The accessory equipment for heat treating, including the oil-quenching equipment, washing machine, circulating fans, atmosphere generator, and conveyer. The tempering furnace and details of furnace construction. (Concluded.)

**18-270. Immersion Heating. Part II.** Maurice J. Dewey. *Industrial Heating*, v. 14, Dec. 1947, p. 1992, 1994, 1996, 1998, 2000, 2006.

The categories to which the principle of immersion heating can be applied: water heating, oil heating, soft-metal melting, salt baths, acid heating, and controlled quenching. (To be continued.)

**18-271. Lakeside Steel Improvement Co. Has Complete Heat Treating Facilities. Part II.** *Industrial Heating*, v. 14, Dec. 1947, p. 2067-2068, 2070, 2072, 2074, 2076.

The continuous furnace, induction-hardening equipment, flame hardening equipment, annealing, stress-relieving and tempering furnaces, and auxiliary equipment for straightening, inspection, and control. (Concluded.)

**18-272. Use of Modified Martempering for Hardening Intricately Shaped Dies.** Wilhelm Olson and Gerald Nevins. *Steel*, v. 121, Dec. 15, 1947, p. 88-89, 115.

Salt martempering practically eliminated distortion and produced satisfactory hardness in Mn-Cr-W oil hardening steel, but a noticeable amount of growth occurred. In large dies, considerable trouble was experienced in maintaining proper clearance for dowel-pin holes. Introduction of martempering oil made possible a quench or an equalization temperature intermediate between that of salt and conventional quenching.

**18-273. Operations in the Production of Helicopters at the Bell Aircraft Plant.** Edward L. Kramer. *Machinery*, v. 54, Dec. 1947, p. 164-168.

Nitriding of gears to a case depth of 0.022 in. and bonding of stainless steel to birch-veneer strips by "cycle welding" are two of the operations.

**For additional annotations indexed in other sections, see:**
**16**-156-162-164; **22**-718-763.

## 19 WORKING — Rolling, Drawing, Forging

**19-400. Modern Forging Practice.** *Journal of the Birmingham Metallurgical Society*, v. 27, Sept. 1947, p. 378-390.

Report of a meeting of the Midland Metallurgical Societies, Birmingham, March 27, 1947. General talk by F. E. Stokeld. Drop forging manufacture, by K. Fidler.

**19-401. New Press From Santa Monica.** *Western Machinery and Steel World*, v. 38, Nov. 1947, p. 92-94.

Production of 30-ton shear-and-press combination called Multi-Max by Parker Mfg. Co.

**19-402. The Production of Forgings for Radial and Jet Aircraft Engines at Canton Drop Forging Plant. Part 1: Production of Radial-Engine Cylinders. (To be continued.)** *Industrial Heating*, v. 14, Nov. 1947, p. 1800-1804, 1806, 1808, 1810, 1933.

**19-403. The Effect of Speed of Rolling in the Cold-Rolling Process. Part II. (Concluded.)** H. Ford. *Blast Furnace and Steel Plant*, v. 35, Nov. 1947, p. 1368-1371.

Condensed from *Journal of the Iron and Steel Institute*. 17 references.

**19-404. The Cold Extrusion of Steel.** *Enamelist*, v. 24, Nov. 1947, p. 28-31.

Application and improvement of above process, originally developed by the Germans. (Condensed from *Business Week*, Aug. 9, 1947.)

**19-405. Steel Wire.** *Iron and Steel*, v. 20, Nov. 1947, p. 527.

Use of borax in the dry-drawing process. (Based on Technical Service Bulletin No. 9, Borax Consolidated, Ltd.)

**19-406. Crankshaft Twisting.** *Iron and Steel*, v. 20, Nov. 1947, p. 537-540.

Apparatus in use in Germany for twisting of large crankshafts as part of the forging operation. From B.I.O.S. Report No. 1329.

**19-407. Unique Gathering in Forming.** *Western Machinery and Steel World*, v. 38, Nov. 1947, p. 72-73.

Fabrication of special aluminum "board" used in payroll and other accounting work. The feature emphasized is the drawing of three longitudinal slots, by means of a three-draw operation, close to the edges of the board.

**19-408. Trimming Presses Make Foundry Production Soar.** P. D. Aird. *Modern Industrial "Press"*, v. 9, Nov. 1947, p. 13-14, 18, 34.

Use in production of automotive castings at River Rouge Plant of Ford Motor Co.

**19-409. Designing of Trouble-Free Dies. Part LXXV. Modern Engineering Trends in Presswork.** C. W. Hinman. *Modern Industrial "Press"*, v. 9, Nov. 1947, p. 20

Improvements in multislide machines; circular dials and multi-

*(Turn to page 30)*

# Trends in Automotive Applications of Die Castings Outlined by J. C. Fox

Reported by R. M. McBride
*Metallurgist, Universal Products Co., Inc.*

Speaking on die castings before the November meeting of the Detroit Chapter, J. C. Fox, chief metallurgist, Doehler-Jarvis Corp., confined his remarks largely to trends in the automotive industry and future uses rather than to details of the process. He was introduced by Joseph Gurski, staff metallurgist, chemical engineering division of the Ford Motor Co., who was technical chairman.

While the die-casting process may yet be classed as an art it is gradually emerging as a science, he said. The transition from the manually operated plunger-type machine, requiring three or four husky operators, to the modern, almost automatic machine of today covers 40 years. The designing of dies, die steels, casting technique, machining and inspection methods have made rapid progress along with the derivation of all the present alloys used for die casting.

The zinc-base die castings, because of their good mechanical properties and low ultimate cost, represent about 65% of all die castings produced. Their use is limited, however, to temperatures not appreciably above 200° F. and they suffer some loss of impact strength at subzero temperatures. The zinc alloys have relatively low creep strength.

The aluminum-base die castings are enjoying a steady increase in application. They can be made radiographically sound when necessary and have stability of dimensions. They can withstand low temperatures without affecting original ductility and have excellent corrosion resistance.

The outstanding property of the magnesium castings is their ultralightness. Despite the low modulus of elasticity, magnesium structures can be made more rigid than aluminum or steel of equal weight. It is the easiest metal to machine and—contrary to a general misconception—has good corrosion resistance in ordinary outdoor atmospheres.

In the automotive field the results of tests on sand-cast magnesium automobile wheels suggest the possibility of wheels being die cast. Advantages of magnesium wheels over steel wheels are said to be reduced tire wear, better steering control, reduction in unsprung weight and lighter weight, facilitating tire changing.

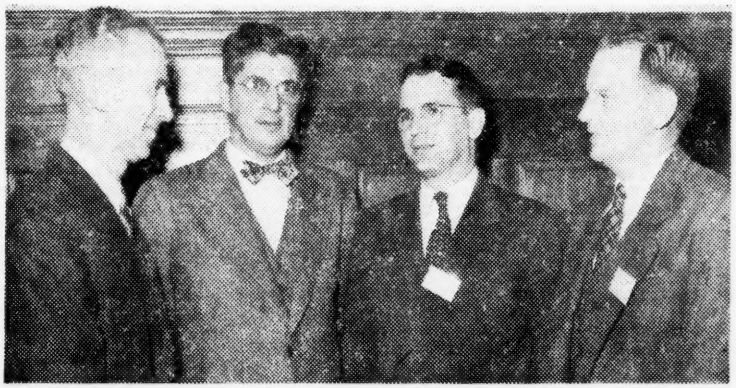
One of the important trends in automotive use is toward aluminum-base die castings in various types of transmissions, such as the hydraulic adaptation of torque converters. Mr. Fox believes that for mass production of nonferrous castings, die casting will eventually displace other metal fabricating processes altogether. When suitable die materials have been developed, copper and brass die castings will assume important roles.

A fine array of die castings was exhibited that ranged from automotive hardware through intricate control housings to spectacle frames.

## Buffalo Chapter Holds Dance

Buffalo Chapter held its annual dinner dance on Nov. 15. The dance itself was given in the usual Buffalo manner, cocktails preceding, continuous music, and dinner at midnight.

## *Worcester Hears About Steel Wire*



*Ralph R. Leo (Second From Left), Division Metallurgist, American Steel & Wire Co., Cleveland, Spoke on "Steel Wire Vs. Cold Heading" at a Dinner Meeting of Worcester Chapter in November. Others taking part were (from left): Lloyd G. Field, chapter chairman; Wade B. Houk, meeting technical chairman; and Henry F. Hillen, works metallurgist at Worcester branch, American Steel & Wire Co.*

## *Compliments*

To DON D. BEACH, engineer and industrial sales manager of the Atlanta Gas Light Co. (and recently appointed chairman of the Constitution and Bylaws Committee), on his installation as president of the Georgia Society of Professional Engineers.

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To E. I. DU PONT DE NEMOURS AND CO., INC., on the establishment of six new fellowships, bringing to a total of 81 the postgraduate and postdoctoral fellowships awarded annually. Among the six new ones is one in metallurgy at Lehigh University.

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To GILBERT S. SCHALLER, professor of mechanical engineering at University of Washington, Seattle, and past chairman of the Puget Sound Chapter, on his election as western district vice-president of the American Welding Society.

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To the following members who were among the winners of top awards (prizes of $1000 to $3200) in the 15 main classifications in the "1946-47 Design for Progress Program" of the James F. Lincoln Arc Welding Foundation: SIDNEY LOW, research and development engineer, Chapman Valve Mfg. Co.; ARNOLD F. MEYER, chief engineer, Heil Co.; GILBERT S. SCHALLER, professor of mechanical engineering, University of Washington; H. J. RALSTON, metallurgist, Carnegie-Illinois Steel Corp.; HARRY L. ANTHONY, III, senior fellow, Mellon Institute of Industrial Research.

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To H. E. HALL, president of Metals Disintegrating Co., on re-election as president of the Metal Powder Association; to S. K. WELLMAN, president of S. K. Wellman Co., on re-election as vice-president; and to ROBERT L. ZIEGFIELD on re-election as acting secretary-treasurer.

## Casting "Art" Required For Complicated Shapes

Reported by Clyde R. St. John
*Senior Metallurgist, Permanente Metals Corp.*

The Inland Empire Chapter (Spokane) was addressed in November by T. R. Stanley, foundry superintendent of the Consolidated Mining and Smelting Co. of Canada, Ltd. He talked on "Metallurgy in a Small Foundry", with the theme that the metallurgist's job is not a strict science, but embodies the "art" of casting as well.

The speaker described the various methods of measuring or indicating temperature and the method of determining and allowing for shrinkage. The greater part of his talk was on the problems of casting complicated shapes and large parts of steel and bronze.

presses; modern trends in forging-press design.

**19-410. Funeral Cars Require Exacting Presswork.** Walter Rudolph. *Modern Industrial "Press"*, v. 9, Nov. 1947, p. 22, 24, 26, 36.

Use of short-life dies and highly skilled finishing methods, particularly for body-panel work, in production of buses, ambulances, and funeral cars.

**19-411. Rolling and Forming of Metal.** H. Maurice Banta. *Metals Review*, v. 20, Nov. 1947, p. 5-7, 55.

Developments during the past year as described in the literature.

**19-412. Equipment and Processes for Rolling, Forging and Presswork.** *Metals Review*, v. 20, Nov. 1947, p. 8-9, 11, 13, 15, 17, 53.

New commercial methods and products for high-speed metal fabrication. Based on manufacturers' literature. Includes names and addresses of manufacturers.

**19-413. Electrical Equipment for the Sendzimir Cold Strip Mill.** H. W. Poole. *Iron and Steel Engineer*, v. 24, Nov. 1947, p. 42-49; discussion, p. 49-51.

Presented before A.I.S.E. Annual Convention, Cleveland, Oct. 3, 1946.

**19-414. Maintenance Kink: Roll Grooving.** *Iron and Steel Engineer*, v. 24, Nov. 1947, p. 92.

Machine for rotating 40-in. blooming-mill rolls on a planer for grooving or "ragging". The tool eliminates use of an overhead electric crane to turn or rotate the roll on the planer bed; eliminates chatter when cutting grooves, resulting in smoother cut grooves; and reduces the time per roll to about 1 hr., 15 min., a saving of 75% over the old method.

**19-415. New Silicon Strip Cold Mill.** F. R. Grant. *Iron Age*, v. 160, Nov. 20, 1947, p. 79-83.

Four-stand tandem mill recently installed at West Leechburg plant of Allegheny Ludlum Steel Corp., and its auxiliary equipment.

**19-416. Forging Tolerances.** *Steel*, v. 121, Nov. 24, 1947, p. 107.

Determining commercial tolerances for closed impression die forgings is greatly simplified by a chart that helps user to determine almost instantly tolerances for any style, shape, and weight of forging up to 500 lb.

**19-417. Semiproduction Runs of Experimental Stampings.** *Iron Age*, v. 160, Nov. 27, 1947, p. 78-79.

Experimental production department utilizes temporary tooling and some 220 small kick presses, for production of small stampings.

**19-418. Advanced Type Equipment Conspicuous in Willys Press Shop.** *Automotive Industries*, v. 97, Dec. 1, 1947, p. 44, 84, 86.

**19-419. Homemade Presses Build Vanette Truck Bodies.** Chester Ricker. *American Machinist*, v. 91, Dec. 4, 1947, p. 89-92.

Ingenious methods and equipment used to convert surplus aircraft channels into delivery-truck bodies.

**19-420. Forming Thin-Metal Cylinders.** Wallace C. Mills. *American Machinist*, v. 91, Dec. 4, 1947, p. 96-103.

Designs for economical and efficient production of small cylinders with open or lock seams.

**19-421. Frozen Dies Form Experimental Parts.** Chester S. Ricker. *American Machinist*, v. 91, Dec. 4, 1947, p. 110-111.

Tripling the strength of Wood's metal dies by freezing in liquid nitrogen makes them suitable for forming thin sheet metal parts.

**19-422. Calculation of Loads Involved in Metal Strip Rolling.** Maurice Cook and Eustace C. Larke. *Journal of the Institute of Metals*, v. 74, Oct. 1947, p. 55-80.

Method for computing rolling loads dispenses with the need for individual determination of the influence of numerous factors, including roll-face distortion. The derivation is based on the assumption that the magnitude of the pure work of rolling is independent of the number of passes used in effecting a given reduction in thickness. The basic experimental data required consist only of a few measured values of rolling loads developed in rolling one material under a series of sets of rolling conditions. From these data, rolling loads can be readily computed for any number of passes. Comparisons with experimental values for steel and copper show good agreement.

**19-423. The Effect of Single and Multi-Hole Die Extrusion on the Properties of Extruded Aluminum Alloy Bar.** L. Northcott, D. McLean, and O. R. J. Lee. *Journal of the Institute of Metals*, v. 74, Oct. 1947, p. 81-93.

Longitudinal streaks on the surface of aluminum alloy components machined from extruded bar in two alloys were found to be associated with erratic circumferential strength. The streaks are caused by the flow structure originating in extrusion through multi-hole die plates. The "radial flow" structure was absent from bars extruded through single-hole die plates. Segregation was found near the periphery in the zone of radial flow. Provision of a central hole in three and four-hole die plates confined the segregate to the axis of the central bar.

**19-424. Forging Die Design—Swaging.** John Mueller. *Steel Processing*, v. 33, Nov. 1947, p. 673-676.

Principles and applications of this process to different types of jobs.

**19-425. Stretching Characteristics of Aluminum Alloy Sheet.** J. M. Taub. *Light Metal Age*, v. 5, Nov. 1947, p. 6-13.

From ASM Preprint No. 12, 1947 (see item 19-273).

**19-426. Carbide Sheet Metal Dies.** Earle Glen. *Machine and Tool Blue Book*, v. 43, Dec. 1947, p. 133-138, 140.

Some of the principles underlying the design of carbide dies, particularly punches.

**19-427. Spinning and Panel-Beating of Aluminum Alloys. Part I.** E. R. Yarham. *Modern Machine Shop*, v. 20, Dec. 1947, p. 124-128, 130, 132.

Some of the principles upon which British methods of fabrication of aluminum alloys are based. (To be continued.)

**19-428. Drop Forging of Turbine Blades Eliminates Machining Operation.** Carl I. Schweizer. *Aviation Week*, v. 47, Dec. 8, 1947, p. 37-38.

Precision process which gives metallurgically superior product with better mechanical properties and close tolerances. Design differences; differences in material; and tooling differences, as well as handling and processing procedures.

**19-429. Huge Presses at Work for Kaiser-Frazer.** *Automotive Industries*, v. 97, Dec. 15, 1947, p. 30-31.

A picture story.

**19-430. Improved Design for Rail and Structural Mills.** H. F. Voigt. *Iron and Steel Engineer*, v. 24, Dec. 1947, p. 55-69; discussion, p. 69.

A combined rail and structural rolling mill built for a steel plant in Europe.

**19-431. The Production of Forgings for Radial and Jet Aircraft Engines at Canton Drop Forging Plant. Part II.** *Industrial Heating*, v. 14, Dec. 1947, p. 1972-1974, 1976, 1978, 1980, 2076.

**19-432. Recent Advancement in the Shaping and Forming of Steel.** *Industrial Heating*, v. 14, Dec. 1947, p. 2014, 2016, 2018.

Summarizes six papers presented at special panel of A.I.S.I. in connection with recent annual meeting in New York.

**19-433. The Rolling of Metals: Theory and Experiment. Part XV—Discussion of Certain Practical Rolling Problems in the Light of the Theory of Rolling. (Continued.)** L. R. Underwood. *Sheet Metal Industries*, v. 24, Dec. 1947, p. 2405-2409.

Effect of strip tension on spread; optimum value of strip tension; methods of applying and controlling strip tension; effects of strip lubrication on various factors. (To be continued.)

**19-434. Improved Production in Drawing With Tungsten Carbide Dies.** *Sheet Metal Industries*, v. 24, Dec. 1947, p. 2425-2426.

Several applications.

**19-435. Production Processes. Their Influence on Design. Part XXX—Wire and Ribbon Forming.** Roger W. Bolz. *Machine Design*, v. 19, Dec. 1947, p. 141-146.

Many components and items made by above process.

**19-436. Steels and Lubricants for High Production Dies.** James Walker. *Tool Engineer*, v. 19, Dec. 1947, p. 29-35.

Graphite steels; Bethlehem "Lehigh H" steel; meehanite; Ampco bronze for draw-die components; bulging dies; chromium plating of dies; Cromovan, a high-carbon, high-chromium tool-steel; nitriding; graphite nitralloy; carbide dies; lubrication of dies; viscosity and boundary lubrication; drawing compounds.

**19-437. Die-Grams.** Karl L. Bues. *Western Machinery and Steel World*, v. 38, Dec. 1947, p. 109-110.

Production by drawing of dome-shaped name plate, made of 0.025-in. brass and electro-etched with company name and other information.

**19-438. Design Innovations in Punches and Ejectors.** Federico Strasser. *Tool & Die Journal*, v. 13, Dec. 1947, p. 62-64.

**19-439. Which Should You Specify—Drawing or Forming Dies?** Charles R. Cory. *Machinery*, v. 54, Dec. 1947, p. 176-182.

Answer depends upon the part. Proper dies for each of several types of parts.

**19-440. Heater Manufacture at Evans Products Co. Puts New Demands on Flexibility of Presses.** P. D. Aird. *Modern Industrial "Press"*, v. 9, Dec. 1947, p. 13-14, 18, 20, 54.

Procedures and equipment in above plant.

**19-441. Simplified Production of Steel Shelving Primarily Involves Efficient Presswork.** Walter Rudolph. *Modern Industrial "Press"*, v. 9, Dec. 1947, p. 24, 26, 28.

**19-442. Knapp-Monarch Uses a Variety of Presses to Form Electrical Appliances.** Gerald E. Stedman. *Modern Industrial "Press"*, v. 9, Dec. 1947, p. 36, 38, 40, 42.

**19-443. Hobbed Cavities for Metals and Plastics.** Thomas A. Dickinson. *Modern Industrial "Press"*, v. 9, Dec. 1947, p. 46, 48.

Use of hobbing technique to produce molds for plastics and metals. The cavity or its parts are produced by means of hydraulic pressing of hardened toolsteel patterns into relatively soft steel blanks.

**19-444. Rocket-Jet Aircraft.** S. Adams. *Modern Industrial "Press"*, v. 9, Dec. 1947, p. 50, 52.

Use of press forming in fabrication of the above.

**19-445. Selection of Stripper Springs.** J. R. Paquin. *American Machinist*, v. 91, Dec. 4, 1947, p. 153.

Rules and calculation methods for selection and application of springs for stripper plates in modern high-speed dies.

**19-446. Stampings for Welded Fabrication Cut Costs and Increase Production.** Charles G. Herbruck. *Iron Age*, v. 160, Dec. 11, 1947, p. 102-104.

*(Turn to page 32)*

# Extensive Use of Zirconium Predicted By B. A. Rogers

Reported by L. Wiley Cooper
*Iowa State College*

The impression that there is every possibility of extensive use of zirconium in the near future, although its present use is limited, was left with members of the Des Moines Chapter after listening to an address on "Zirconium, Its Properties and Production" by B. A. Rogers of the United States Bureau of Mines. Dr. Rogers is on leave of absence from the Bureau of Mines and is now conducting research work at Iowa State College.

The resistance of zirconium to attack by alkalis and acids places it in a favorable position for extensive use by the chemical industries, if the cost of production can be reduced to a suitable figure, Dr. Rogers said. Values of tensile strength in excess of 100,000 psi. have been reported for the cold drawn wire. The deep drawing properties of the metal are good.

Dr. Rogers was associated with the U. S. Bureau of Mines in Albany, Ore., where large quantities of zircon sand were available as a byproduct from operations on chromite-bearing sands. The process of refining zirconium metal from zircon sands was developed by W. J. Kroll, a Luxembourg metallurgist with an extensive consulting practice in the rare and unusual metals. Dr. Kroll came to the United States in 1940 and has been at Albany for the last three years as a consultant to the Bureau.

The reduction process primarily consists of pouring a mixture of zircon sand and carbon into an electric arc, thus forming the zirconium and silicon carbides directly. In the next step, chlorine is passed through the products of the electric arc, forming zirconium and silicon chlorides. The zirconium is condensed in an apparatus held at 200° C., the silicon chloride passing off as a vapor.

Final refinement consists of reacting the zirconium chloride with molten magnesium, forming the products — metallic sponge zirconium and magnesium chloride. Some magnesium metal remains with the reacted substances. The magnesium and magnesium chloride are driven off by a vaporization process, leaving what is essentially pure zirconium that can be melted if desired.

Following his talk, Dr. Rogers exhibited several samples of zirconium in various stages of refinement and manufacture, including what is probably the world's only zirconium watch case.

## Spring Design, Manufacture And Applications Described

Reported by Floyd B. Allen
*Tool Engineer, Remington Rand, Inc.*

"The Practical Uses of Springs" was a difficult subject ably handled from the standpoints of design, manufacture and application, when Ralph H. Joerres, planning manager and chief engineer, Wallace Barnes Co., addressed the Southern Tier Chapter on Nov. 10. Mr. Joerres cited many examples of wartime applications to illustrate common errors in design which make manufacture costly and difficult. He then showed how revisions were made for economical manufacture and high production. The importance of control over the raw material for uniformity, and the value of experience in the tricks of the trade to produce to spring specifications, were stressed.

## *Technical Papers Invited*

The Publications Committee of the A.S.M. will now receive technical papers for consideration for publication in the 1949 *Transactions*. A cordial invitation is extended to all members and nonmembers of the A.S.M. to submit technical papers to the society. Many of the papers approved by the committee will be scheduled for presentation on the technical program of the 30th National Metal Congress and Exposition to be held in Philadelphia, Oct. 25 to 29, 1948. Papers that are selected for presentation at the Convention will be preprinted and manuscripts should be received at A.S.M. headquarters office not later than April 15, 1948.

Manuscripts in triplicate, plus one set of unmounted photographs and original tracings, should be sent to the attention of Ray T. Bayless, assistant secretary, American Society for Metals.

Headquarters should be notified of your intention to submit a paper, and helpful suggestions for the preparation of technical papers will be sent.

## Laboratory Directory Available

A complete listing of commercial and university testing and research laboratories throughout the country, together with indications of the type of commodities tested, has been compiled by the National Bureau of Standards. This pamphlet is now available from the Government Printing Office as NBS Miscellaneous Publication M187 entitled "Directory of Commercial and College Laboratories". It may be obtained only from the Superintendent of Documents, Washington 25, D. C., at 30 cents per copy.

# Pointers Given on Stainless Fabricating

Reported by Henry Hauseman
*Metallurgist*
*LaPlant-Choate Mfg. Co., Inc.*

The wide variety of industries using stainless steels, and the types required by each, were described and illustrated by S. P. Odar, district metallurgist, Republic Steel Corp., Massillon, Ohio, before the Cedar Rapids Chapter on Nov. 11.

Mr. Odar introduced his subject, "The Processing and Fabricating of Stainless Steel", by a résumé of their discovery and development. He then described the physical properties in the annealed and cold rolled state of the nonhardenable grades, and the annealed and heat treated state of the hardenable grades.

After outlining steel mill melting and finishing practices, Mr. Odar showed another group of slides to illustrate methods for punching, shearing, forming, deep drawing and spinning stainless steel. Precautions for welding, silver soldering and forging were outlined. Turning to machining, Mr. Odar advised the use of the free-machining grades where considerable machining is required. These grades, which have sulphur or selenium additions, are machinable at speeds and feeds approximating 90% of those used for ordinary screw stock.

## Parsons to Direct Coast Sales for Pacific Scientific

The activities of Pacific Scientific Co. as Pacific Coast representatives of Wilson Mechanical Instrument Co., Hevi Duty Electric Co., Lindberg Engineering Co., Tinius Olsen Testing Machine Co., and Induction Heating Corp. are to be more closely knit, according to a recent announcement, by the appointment of W. J. Parsons to a newly created position. Mr. Parsons will be sales manager of the heavy industrial division for the entire company, including its Los Angeles, San Francisco and Seattle offices.

*W. J. Parsons*

"Bill" Parsons has been active in his chosen field for some 19 years, of which over 11 years have been spent with Pacific Scientific Co. in charge of the work of this division in Southern California. For over eight years he has been secretary-treasurer for the Los Angeles Chapter. His headquarters will continue to be at Los Angeles, from which he will direct coastwise sales of furnaces, induction and dielectric heating equipment, as well as hardness and physical testing equipment.

Addition of a 500-ton hydraulic press to its mechanical press department has enabled Lincoln Electric Co. to eliminate certain machining operations, casting and forging purchases, and subcontracting. Use of this press to perform a variety of operations.

**19-447. A Simple Method of Forming Sheet Metal.** *Iron Age*, v. 160, Dec. 18, 1947, p. 71.

Use of a hand-operated air hammer, a press, and wooden molds to draw sheet metal into various designs.

**19-448. Fabricating Steel Hardware.** *Steel*, v. 121, Dec. 22, 1947, p. 71-72, 86, 88.

A variety of hot and cold working methods used in manufacturing industrial fasteners and hardware.

**19-449. Fabricating Rolled Steel Draft Gears for Railroad Cars.** E. F. Ross. *Steel*, v. 121, Dec. 29, 1947, p. 46-48.

Forging and welding techniques followed by A. O. Smith Corp. to turn out couplings engineered to withstand repeated severe impacts.

**For additional annotations indexed in other sections, see: 7-479; 17-106; 21-109-110; 23-533-545; 24-380-382-400-418; 27-256-265-272-278.**

## 20 MACHINING AND MACHINE TOOLS

**20-663. Standardized Fixtures for Machine Work.** *Aircraft Engineering*, v. 19, Oct. 1947, p. 334-335.

**20-664. Machining Stainless Steel Valves.** A. P. Nelson. *Machinery (London)*, v. 71, Oct. 30, 1947, p. 479-483.

Recommended practice and tools for turning, drilling, and threading stainless steel parts, and the coolant employed in machining operations.

**20-665. Vernier for Setting Vertical Turret.** *Machinery (London)*, v. 71, Oct. 30, 1947, p. 483.

Use to facilitate accurate setting of the turret of a Bullard vertical lathe for turning short tapers.

**20-666. Safe Feeds and Speeds for High-Speed Twist Drills.** *Machinery (London)*, v. 71, Oct. 30, 1947, p. 489.

A tabulation covering important ferrous and nonferrous materials.

**20-667. V-Block for Odd-Shaped Punches.** *Machinery (London)* v. 71, Oct. 30, 1947, p. 498.

**20-668. Form Tools.** William F. Walker. *Edgar Allen News*, v. 26, Nov. 1947, p. 941-944.

Dovetail form tools; tipped tools; composite tools. (To be continued.)

**20-669. Machining Cast Aluminum Alloys.** J. J. Stobie, Jr. *Modern Metals*, v. 3, Nov. 1947, p. 16-23.

Tooling, cutting compounds, lathe practice, cutting speeds, shaping, drilling, reaming, tapping, threading, sawing, and filing. 48 ref.

**20-670. Machining Castings.** A. O. Schmidt. *American Foundryman*, v. 12, Nov. 1947, p. 22-27.

Methods used to determine machinability, to determine tool life, effect of cutting speeds, of rake and clearance angles, and of milling-cutter blade arrangements.

**20-671. Experimental Study of Cylindrical Grinding.** R. E. McKee, R. S. Moore, and O. W. Boston. *Transactions of the A.S.M.E.*, v. 69, Nov. 1947, p. 891-896.

Investigation of the grinding process; variables such as table-traverse feeds, depths of cut, wheel grain and grade, and type and concentration of cutting fluid.

**20-672. Stockton Tools Four Continents.** Gordon B. Ashmead. *Western Machinery and Steel World*, v. 38, Nov. 1947, p. 66-71.

Procedures and equipment of Rheem Mfg. Co. for making machine tools.

**20-673. Precision Tooling in Miniature.** *Western Machinery and Steel World*, v. 38, Nov. 1947, p. 82-83, 104.

Miniature lathe is less than 10 in. long, 3¾ in. wide, and 6¾ in. high, and has many applications in jewelry, radio, and other fields.

**20-674. Jigs and Fixtures Accelerate Heavy Band Saw Cuts.** H. J. Chamberland. *Western Machinery and Steel World*, v. 38, Nov. 1947, p. 87-89.

Recent improvements in band-saw cutting of metals.

**20-675. Form-Dressing of Grinding Wheels.** W. A. Carter. *Aircraft Production*, v. 9, Nov. 1947, p. 407-411.

Advantages of two methods, summing up rather in favor of the crusher roll for production machining.

**20-676. Machining Turbine Blades. Part I. Specialized Equipment for Turning, Grinding or Milling Efficient Profiles.** T. A. Kestell. *Aircraft Production*, v. 9, Nov. 1947, p. 412-415.

Review is based upon a paper prepared for reading before the Institution of Mechanical Engineers on Oct. 31st under the title, The manufacture of turbine blades for the whittle engine. (To be concluded.)

**20-677. Slitting Rotating Work.** *Aircraft Production*, v. 9, Nov. 1947, p. 416.

Unconventional automatic tooling.

**20-678. High-Speed Pictures for High-Speed Production.** *Modern Industry*, v. 14, Nov. 15, 1947, p. 81-82, 84, 86.

High-speed motion-picture photography for analysis of rapid movements has proved useful in solving a large number of production problems, including determination of most efficient rake angle on planing and milling machines, by observation of chip formation in slow motion.

**20-679. Special Tooling Used in Machining Heavy Processing Equipment.** *Steel*, v. 121, Nov. 24, 1947, p. 86-88, 122.

Some of the equipment used to produce absorption plants, cane crushers, concentrators, crystallizers, digesters, dryers, evaporators, extractors, fractionating columns, nicotine sulphate plants vacuum pumps, Vallez rotary filters, vulcanizers, Webb cotton presses and other heavy equipment.

**20-680. Electronically Controlled Multiple-Wheel Grinder.** *Automotive Industries*, v. 97, Dec. 1, 1947, p. 34.

Multiple-wheel crankshaft grinder, installed at Packard for grinding the main-bearing line of its eight-cylinder engine crankshaft.

**20-681. Practical Ideas.** *American Machinist*, v. 91, Dec. 4, 1947, p. 115-120.

Seam-welder cleaning attachment improves weld quality and finish, by Charles Kidwell. Sharper toolholder permits large range of tool positions for die work in confined locations, and eccentric boring chuck simplifies fly-cutter milling and boring, by George A. Giller. Measuring actual diameter of bevel gears, by Hubert C. Smith. Measuring convex arc radii, by S. Framurz. Die-milled serration cutter which can be reground indefinitely, by Charles Kidwell. Clock spring retracts miller table in automatic cycle, by Burl W. Mansberger. Hot-spinning flares steel tubes, by B. L. Wade. Geared angle vise speeds die work, by J. A. Peterson. Swing and ball-joint fitting adjusts cutting-oil flow, by Chris Winkler. Other miscellaneous shop hints.

**20-682. B.S.A. No. 48 Single-Spindle Automatic Screw Machine.** *Machinery Lloyd (Overseas Edition)*, v. 19, Nov. 8, 1947, p. 84-86.

British-made machine tool.

**20-683. Tooling the Automatic Screw Machine. Part XX.** Noel Brindle. *Modern Machine Shop*, v. 20, Dec. 1947, p. 134-136, 138, 140, 142, 144, 146, 148, 150, 152, 154, 156, 158, 160, 162, 164.

Procedure to follow in designing cams for the Brown & Sharpe automatic screw machine.

**20-684. Time Saving of 60% With Modern Machine Tool.** *Modern Machine Shop*, v. 20, Dec. 1947, p. 197-198, 200, 202.

Use of 16-in. "electric-cycle" Warner & Swasey screw machine for machining a ⅜-in. brass angle valve and also for other miscellaneous production applications.

**20-685. Ideas From Readers.** *Modern Machine Shop*, v. 20, Dec. 1947, p. 204, 206, 208, 210.

Hopper feed fixture for milling machine. Mirror reflects progress in grinding die chasers. Car wheel lift, by Bartlett West. Attachment for burring drilled holes, by Gerald Eldridge Stedman.

**20-686. Ingenious A-C Adjustable Speed Drive.** *Product Engineering*, v. 18, Dec. 1947, p. 128-129.

Drive with substantially flat speed regulation used to power the regulating wheel on the Landis Tool centerless grinder. (From "A New Drive for a New Machine for a New Technique", by W. E. Happel. Presented at 1947 Westinghouse Machine Tool Electrification Forum, Buffalo, N. Y.)

**20-687. Service Life of Machine Tools Extended by Cemented Carbides.** Harry Crump. *Production Engineering & Management*, v. 20, Dec. 1947, p. 56-60.

How rapid wear of critical parts can be retarded by a judicious application of cemented carbides.

**20-688. Novel Lathe Accessory.** R. C. Spain. *Production Engineering & Management*, v. 20, Dec. 1947, p. 81.

Device which, when attached to an engine lathe having V-ways, will automatically measure axial movement of the turning tool, boring bar, or threading tool as the carriage moves along the lathe ways.

**20-689. Four Outstanding Tooling Ideas.** S. L. Daugherty. *Screw Machine Engineering*, v. 9, Dec. 1947, p. 38-41.

Use of four unique ideas to permit production of a Sheaffer fountain-pen part of nickel-silver on an automatic screw machine.

**20-690. Worm Generating on the Automatic Screw Machine.** *Screw Machine Engineering*, v. 9, Dec. 1947, p. 43-46.

**20-691. Screw Machine Engineering Data Sheet; Circular Forming Tool Holders.** *Screw Machine Engineering*, v. 9, Dec. 1947, p. 51.

Diagrams and a table of dimensions.

**20-692. Profitable Use of Screw Machine Attachments.** *Screw Machine Engineering*, v. 9, Dec. 1947, p. 52-55.

Five alternate methods for producing a typical small part, showing advantages of screw-machine processing.

**20-693. Extended Turret Stop for Brown & Sharpe Automatics.** John G. Ozga. *Screw Machine Engineering*, v. 9, Dec. 1947, p. 57.

Simple method illustrated extends the length capacity of any model Brown & Sharpe automatic.

**20-694. Stock Ends.** *Screw Machine Engineering*, v. 9, Dec. 1947, p. 59.

Combined releasing and nonreleasing holder, by George Schrader. Positioning of the turret. Stock reel lock.

**20-695. Rapid Method of Producing Powdered-Metal Aircraft Parts.** *Machinery*, v. 54, Dec. 1947, p. 146.

How grooving operations on powdered-metal aircraft parts are being performed four times faster by the conversion of a standard Walker-Turner radial cut-off machine to an automatic grooving unit. The cut-off machine is equipped with a diamond-impregnated metal wheel and a magnetic chuck mounted on an automatic index table.

*(Turn to page 34)*

# Heat Treat Research Improves Behavior Of Steels in Service

Reported by George W. Young
*Assistant Metallurgist*
*United States Spring & Bumper Co.*

The modern trend in the philosophy of heat treatment is toward greater consideration for field service requirements rather than chemistry, according to Raymond A. Grange of the United States Steel Corp. Research Laboratory. "New Developments in Physical Metallurgy of Steel" was the subject of his talk presented to the Los Angeles Chapter in November.

To improve the behavior of steels in service much research has been devoted to controlled hardening, reduction of susceptibility to distortion and cracking in heat treating due to residual stresses, and a lessening of temper brittleness. Where optimum properties are desired, the importance of adequate hardenability to insure essentially all martensite on quenching was well demonstrated by experience with ordnance materiel, Mr. Grange noted. This has tended to promote acceptance of H-steels in which restricted hardenability limits are specified.

The innovation of N.E. steels during the war proved so popular that some of them are being retained, particularly the 8600, the 8700 and the 9400 series. Boron-treated steels also were developed during the war and seem likely to remain, according to Mr. Grange. These steels may be designated by adding the letter B to the standard A.I.S.I.-S.A.E. numbers—for example, S.A.E. 10B45. As little as 1 lb. of boron in 100,000 lb. of steel is sufficient to give increased hardenability to killed steel; the hardenability effect of this element is inversely proportional to the carbon content.

New testing methods and equipment reviewed by the speaker included improved notched-bar tests performed at lower temperatures for greater sensitivity; torque magnetometer for testing deep drawing properties of steel; X-ray spectrometry; electron microscope for greater resolution; electron diffraction camera, electrolytic polishing of stainless steel, coated lenses and color in microscopy; and super high-speed photography.

Among some excellent slides shown throughout the program, Mr. Grange included a few high-speed shots demonstrating the different stages of an end-quench test.

## New Members of A.S.M. Quarter Century Club

The following A.S.M. members have been awarded honorary certificates commemorating 25 years' consecutive membership in the society:

### Hartford Chapter

Carpenter Steel Co. (sustaining membership represented by W. F. Rossiter), A. H. d'Arcambal, Berger Egeberg, Henry Fischbeck, John P. German, F. P. Gilligan, L. G. Grant, Carl T. Hewitt, F. O. Hoagland, F. G. Hughes, John C. Kielman, Henry I. Moore, Pratt & Whitney Co. (represented by Herbert Petto), E. A. Sanford, Spencer Turbine Co. (represented by H. H. Richardson), Horace W. Staples, A. J. Trapp, T. G. Treadway, Union Hardware Co. (represented by W. F. Hoerle), Albert Vuillemier, J. M. Washburn, R. W. Woodward.

### Philadelphia Chapter

George Metzger.

## Foundry House Organ Issued

A new publication—*Foundry Metals Digest*—has been issued by Federated Metals Division, American Smelting and Refining Co. Containing semi-technical material of interest to the users of nonferrous castings, it will be distributed four times annually to the customers of foundries in order to stimulate greater interest in nonferrous castings.

Copies are supplied to foundries gratuitously by Federated Metals Division, or mailed for the foundry to its own lists. It is available by writing Federated Metals Division, American Smelting and Refining Co., 120 Broadway, New York 5, N. Y.

*Hardenability Buying of Alloys Made Easy by Ryerson Tests*

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**RYERSON STEEL**

**20-696. Electronic Motor Drives Increase Machine Tool Versatility.** R. B. Crawford. *Machinery*, v. 54, Dec. 1947, p. 156-159.

Advantages of the above.

**20-697. Broaching Jet-Propulsion Engine Parts.** *Machinery*, v. 54, Dec. 1947, p. 169-170.

Fixture used in the above.

**20-698. Tool Engineering Ideas.** *Machinery*, v. 54, Dec. 1947, p. 189-191.

Fly cutter of wide range, by Robert Mawson. Lathe fixture for pointing spindles, by Harold E. Murphey.

**20-699. Machining Turbine Blades. Part II. Blade Analysis; Work-Holding; Cam Development.** T. A. Kestell. *Aircraft Production*, v. 9, Dec. 1947, p. 460-465.

The main theoretical considerations underlying the design and use of the Kestell blade-profiling machine and its associated equipment. (Condensed from "The Manufacture of Turbine Blades for the Whittle Engine", presented to Institution of Mechanical Engineers.)

**20-700. Cost Cutting With Multiple Broaching.** *Tool Engineer*, v. 19, Dec. 1947, p. 20.

How three splines are broached in each of four S.A.E. 1112 steel, bicycle coaster-brake-hub shells in one pass and at the rate of 630 pieces per hr.

**20-701. A Quick-Acting, Positive Drill Jig.** Robert Mawson. *Tool Engineer*, v. 19, Dec. 1947, p. 36.

Simple design provides quick loading and unloading for small-lot production runs.

**20-702. Accurate Broaching of Round Holes.** Frank Zagar. *Tool Engineer*, v. 19, Dec. 1947, p. 37-39.

Various means of producing round, straight holes under adverse conditions.

**20-703. Transfer-Matic Speeds Production.** Watson N. Nordquist. *Tool Engineer*, v. 19, Dec. 1947, p. 44.

How a cross 5-station, automatic-cycle machine produces 150 rear-axle housings hourly with a single operator.

**20-704. Machining by Erosion.** B. R. Lazarenko and N. I. Lazarenko. *American Machinist*, v. 91, Dec. 4, 1947, p. 120-121.

New Russian machine tools which are said to form holes to almost any shape and to dress tools without causing surface flaws by use of a vibrating, but not rotating, spindle to which a tool of almost any desired shape may be attached.

**20-705. Practical Ideas.** *American Machinist*, v. 91, Dec. 4, 1947, p. 129-134.

Adjustable jig for locating double centers, by H. Moore. Double-crank adjustable miller table for circular cuts, by Charles Schisler. Triple-unit reamer tap for finishing large holes and hand tool for burring deep recesses, by Charles Kidwell. Drill jig to replace vise jaws, by Arthur F. Hird. Split chuck for short diversified jobs, by Arthur Silvester. Two-flute floating reamer for centering large bores, by Martin H. Ball. Short-stroke press for cup drawing, by Bernard Berman. Screw device to control helical-flute grinding, by A. A. Sinisi, and other miscellaneous shop hints.

**20-706. Radius-Truing Centerless Grinder Wheels.** *Iron Age*, v. 160, Dec. 11, 1947, p. 93.

Device designed by a British firm which enables a variety of radii to be generated on a grinding wheel.

**20-707. Solving Common Bandsawing Troubles.** *Iron Age*, v. 160, Dec. 18, 1947, p. 59.

Many of the common troubles; corrective recommendations.

**For additional annotations indexed in other sections, see:**
**19**-414; **21**-118; **23**-471-532; **24**-397-410-414; **27**-252-258-267.

## 21 LUBRICATION and Friction; Bearings

**21-108. Soluble Oils for Cutting and Grinding Operations.** C. M. Larson. *Iron and Steel Engineer*, v. 24, Nov. 1947, p. 73-76; discussion, p. 76-77.

Types and applications. (Presented at A.I.S.E. Annual Convention, Cleveland, Oct. 4, 1946.)

**21-109. Lubrication in Drawing Operations.** E. A. Evans, H. Silman, and H. W. Swift. *Engineering*, v. 164, Nov. 7, 1947, p. 454-455.

Condensed from *Sheet Metal Industries*, v. 24, Oct. 1947, p. 1995-2002; Nov. 1947, p. 2209-2213, 2216 (see item 21-107). (Presented at Autumn Conference of Sheet and Strip Metal Users' Technical Assoc., London, Sept. 25, 26, 1947.)

**21-110. Importance of Lubrication in Forging Operations.** A. F. Brewer and J. C. Van Gundy. *Steel*, v. 121, Dec. 1, 1947, p. 92-95, 102, 104, 106, 109.

Need for efficient lubrication in maintenance of forging equipment. Design of machinery components in relation to heat, pressure, water, and lubricant contamination.

**21-111. Dry Friction of Metals as Affected by Surface Finish and Surface Coatings.** N. Ludwig. *Engineers' Digest (American Edition)*, v. 4, Nov. 1947, p. 516-517.

Apparatus for measuring sliding frictional resistance by use of a test cube pressed against a plane surface. Effect of surface finish was determined for four metals or alloys and for four grades of mechanical smoothness: rough machined; fine machined; ground; and polished. The frictional resistance of ten different surface coatings of either phosphated or plated types was also determined. (Translated and condensed from *Die Technik*, v. 2, April 1947, p. 166-170.)

**21-112. Research Into the Laws of Heat Dissipation in Journal Bearings.** Ch. Hanocq. *Engineers' Digest (American Edition)*, v. 4, Nov. 1947, p. 530-533.

Experiments which resulted in new and more accurate formulas for the design of bearings. Influences of bearing metal, self-alignment, film lubrication, and dimensional relationships reduced to mathematical expressions. A short, self-aligning bearing gives best results. (Translated and condensed from *Revue Universelle Des Mines*, v. 3, 1947, p. 245-258.)

**21-113. Brinelling of Ball and Roller Bearings.** *Product Engineering*, v. 18, Dec. 1947, p. 127-128.

Ball and roller-bearing failures can result from light, high-frequency impacts repeatedly striking the same area in the periphery of the bearing races. Calculations from experiences in reducing bearing failures caused by vibrations. (Translated and condensed from "A Study of Rhythmic Phenomena in Roller Bearings", *Schweiz. Technische Zeitschrift*, v. 46, Nov. 1946.)

**21-114. Pouring Better Babbitted Bearings.** Wm. H. Parché. *Industry and Power*, v. 53, Dec. 1947, p. 95-96, 110, 113-114.

Recommended procedures.

**21-115. Care and Control of Coolants.** H. P. Wilkinson. *Screw Machine Engineering*, v. 9, Dec. 1947, p. 47-50.

**21-116. Sliding Friction of Ball Bearings of the Pivot Type.** H. Poritsky, C. W. Hewlett, Jr., and R. E. Coleman, Jr. *Journal of Applied Mechanics*, v. 14, (*Transactions A.S.M.E.*, v. 69), Dec. 1947, p. A261-A268.

While ideally, pivot and race surfaces can touch the ball surfaces only at mathematical points, these surfaces actually flatten due to elastic compression so that contact occurs over a finite area. As a result of this flattening, even the most precise and flawless ball bearings possess definite friction. This source of unavoidable friction is analyzed, and the frictional torque due to it is computed for an individual ball, for the whole bearing, and for both bearings holding a rotor or gimbal. (Presented at Meeting of Applied Mechanics Division of A.S.M.E., Schenectady, N. Y., June 23-25, 1947.)

**21-117. Antifriction Bearings.** L. E. Browne. *Steel*, v. 121, Nov. 17, 1947, p. 90-91, 126, 128; Dec. 1, 1947, p. 88-89, 114, 116, 120; Dec. 8, 1947, p. 96-98, 100, 102; Dec. 29, 1947, p. 50-53.

Fundamentals of bearing practice, including design considerations, and some typical industrial applications. Some typical applications on milling, boring, turning, and grinding equipment. Needle bearings and the part they play in the design of various types of industrial machinery. Various bearings used in railroad rolling stock. (To be continued.)

**21-118. The Effect of Cutting Fluids on Drilling Thrust and Torque.** John G. Floden. *Tool Engineer*, v. 19, Dec. 1947, p. 21-24.

An investigation of the action of coolants in conjunction with cutting speeds and feeds.

**21-119. New Developments in Babbitting Methods.** J. T. Clenny. *Iron Age*, v. 160, Dec. 25, 1947, p. 62-69.

Many new methods, with particular emphasis on cleaning and pickling operations and on the metallurgical considerations involved.

**For additional annotations indexed in other sections, see:**
**19**-433-436.

## 22 WELDING Flame Cutting; Riveting

**22-665. British Shipbuilding. Part III. The Wallsend Yard of Swan, Hunter, and Wigham Richardson, Ltd.** *Welding*, v. 15, Oct. 1947, p. 452-459, 491.

Practice and equipment with special reference to building of oil tankers.

**22-666. Atomic Hydrogen Welding; With Control of Carbon.** *Welding*, v. 15, Oct. 1947, p. 460-464.

The Athyweld atomic-hydrogen welding process, which is claimed to give perfect carbon control, for the repair of worn tools and for building up new tools.

**22-667. Heating and Ventilating Systems; Notes on Special Welding Technique.** T. F. Mott. *Welding*, v. 15, Oct. 1947, p. 465-467, 497.

Practical aspects of pipe welding for heating and ventilating systems. Preparation and technique; repair and maintenance.

**22-668 Oxygen Cutting; Deseaming and Gouging. (Continued.)** E. Seymour Semper. *Welding*, v. 15, Oct. 1947, p. 468-472.

Modern practice in manual and machine cutting. (To be continued.)

**22-669. Choose the Right Electrode. (Continued.)** W. D. Waller. *Welding*, v. 15, Oct. 1947, p. 472-479.

The various types of electrode available. (To be concluded.)

**22-670. Resistance Welding in Mass Production; Jigs and Tools for Projection Welding. (Continued.)** A. J. Hipperson and T. Watson. *Welding*, v. 15, Oct. 1947, p. 480-491.

*(Turn to page 36)*

## Future of Metallurgy Lies in Physics Rather Than Chemistry

Reported by John F. Collins
*O'Brien Fellow in Metallurgy*
*University of Notre Dame*

"Metallurgy—Ancient Art and Modern Science" was the subject of an address by Cyril Stanley Smith before the Dec. 10th meeting of the Notre Dame Chapter. Dr. Smith is director of the Institute for the Study of Metals at the University of Chicago, and is a member of the General Advisory Committee of the Atomic Energy Commission.

In tracing the history of metallurgy, Dr. Smith pointed out that from the Roman Empire until the latter part of the 18th century metallurgy was an art and not a science. During the 19th century when so many advances were being made in chemistry it was only natural that metallurgy should become associated with chemistry and the chemist. Recently, however, metallurgy has been more intimately associated with physics, and, according to Dr. Smith, the future of metallurgy lies in physics rather than in chemistry. The structure of metals will be more important than their composition.

Dr. Smith attributed the relatively slow advancement of metallurgy to the lack of demand for new materials on the part of the builder. Cannons, for example, were cast for several hundred years, and only recently has a new method been devised for making them, requiring better metallurgical methods. Today, however, the pressure is on the metallurgist to develop new materials to meet ever-changing specifications.

The talk was illustrated by slides of woodcuts illustrating early metallurgical practice.

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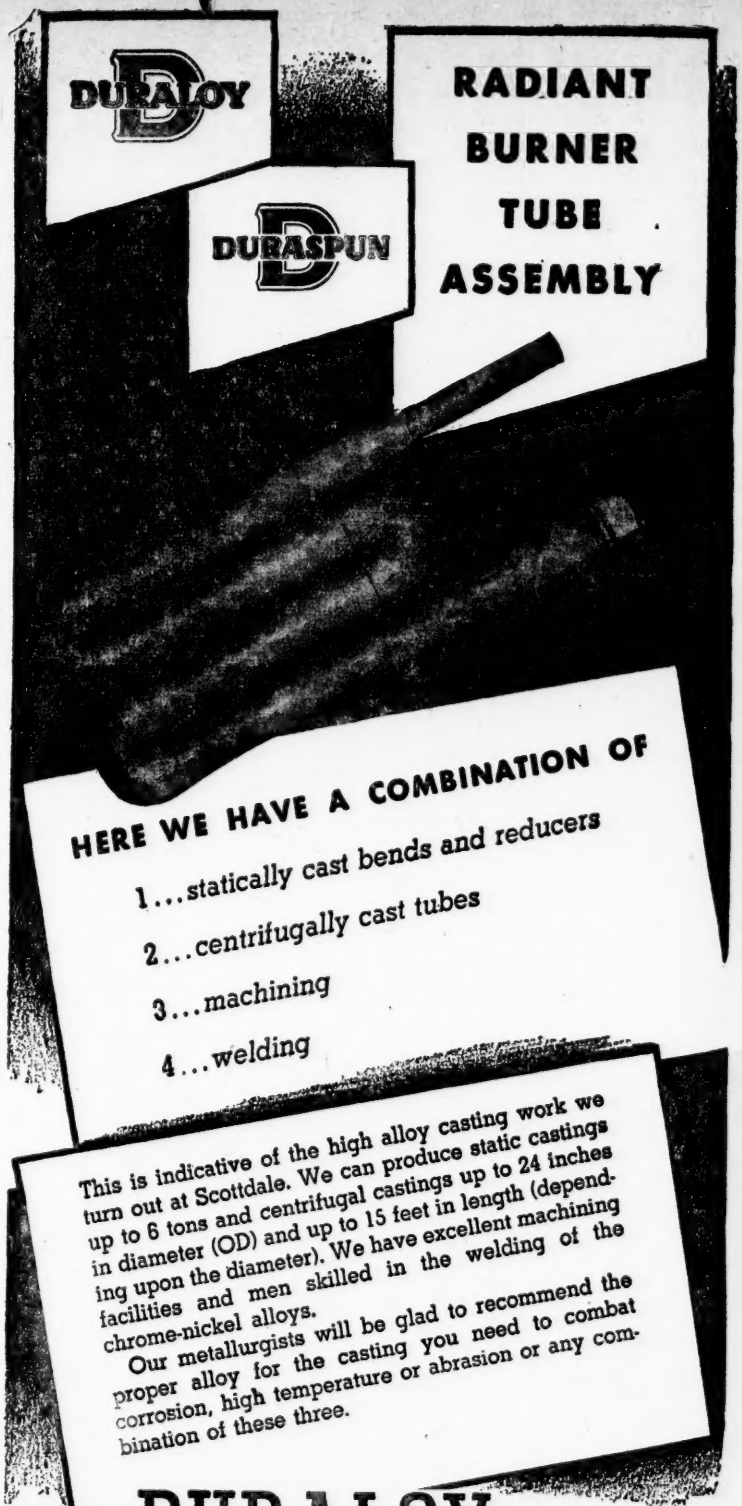
## Conley Opens Lecture Course on Fundamentals

Reported by Floyd B. Allen
*Tool Engineer, Remington Rand, Inc.*

The first of a series of lectures on "The Fundamentals of Metallurgy", forming part of an educational project of the Southern Tier Chapter, was held in Elmira, N. Y., on Nov. 18. The project is directed by James Ryan, metallurgist, Eclipse Machine Division. Thirty-five attended the first session and 20 more registrations were made for the second session.

W. J. Conley, metallurgical consultant and formerly on the engineering staff of University of Rochester, presented the first lecture on the fundamental properties of metals and their alloys. He was successful in keeping the discussions on a level of understanding for all who were present. Many industries are represented in the group with personnel ranging from tool designers and heat treat foremen to general managers, metallurgists and engineers.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Design and arrangement of various jigs and tools. (To be continued.)

**22-671. Fundamentals of Oxy-Acetylene Welding and Cutting.** J. I. Banash. *Steel*, v. 121, Nov. 10, 1947, p. 110-112, 144, 146, 149.

Basic principles of processes; gases and equipment. Flame hardening, softening, priming, gouging, pressure welding, and steel conditioning.

**22-672. Welded Flanges.** G. A. Brewer. *Machine Design*, v. 19, Nov. 1947, p. 125-128.

Calculations and tests indicate no advantage of code-approved joint over simple butt weld.

**22-673. Untersuchung von Elektrisch Geschweissten Konstruktions-elementen aus Aluminium-Legierungen. (Investigation of Electrically Welded Aluminum-Alloy Structural Materials.)** L. Huguenin. *Schweizer Archiv*, v. 13, July 1947, p. 202-210.

Tests on airplane-engine housings. Values for the "O-alternating" tensile tests, using 12% Si electrodes, were equal to those obtained with Silumin cast construction.

**22-674. Smit-Cyc Arc Bout-En Stiftlasapparaat. (Smit-Cyc Arc Butt and Spot Welding Apparatus.)** *Smit Mededelingen*, v. 2, April-June 1947, p. 43-47.

Three models of butt welders for use on ⅛ x ½-in., ¼ x ⅝-in., and ¼ x ⅞-in. bars, respectively. Butt diameter, current consumption, and time. Tensile, bending, and compressive strength of the welded articles.

**22-675. Het Vermogen Van Puntalsmachines. (The Capacity of Spot Welding Machines.)** *Smit Mededelingen*, v. 2, April-June 1947, p. 48-51.

Capacity of the model PT35 spot welder. Data for different load factors and current densities.

**22-676. Automatic Brazing of Small Rotor Ends.** *Electrical Manufacturing*, v. 40, Nov. 1947, p. 116, 118.

Motorized cycle with time control expedites this operation on small squirrel-cage rotors, using oxy-acetylene heating and water quench.

**22-677. Applying Resistance Welding in Tank Production.** *Machinery*, v. 54, Nov. 1947, p. 156-158.

Procedures and equipment used in manufacture of gasoline tanks by White Motor Co., Cleveland.

**22-678. Le Découpage Electrique sous l'Eau. (Underwater Electric Arc Cutting.)** R. Sarazin. *Soudure et Techniques Connexes*, v. 1, Jan-Feb. 1947, p. 7-15.

Methods used before, during, and after the war. Comparison of electric wire cutting in air and under water, and characteristics of underwater cutting are indicated. Work of French engineers on repair of damaged bridges as an example of the application of such methods.

**22-679. Le Problème de la Soudabilité des Matériaux de Coque et l'Expérience de la Marine Francaise et des Constructions Soudées de la Marine de Commerce Américaine. (Problem of Weldability of Materials for Ship Hulls and the Experience of the French Navy vs. the Welding of American Merchant Ships.)** M. Dutilleul. *Soudure et Techniques Connexes*, v. 1, Jan-Feb. 1947, p. 16-24.

**22-680. Contribution a l'Etude des Phénomenes de Dilatation et de Retrait. (Contribution to the Study of Phenomena of Expansion and Contraction.)** P. Berthet. *Soudure et Techniques Connexes*, v. 1, Jan-Feb. 1947, p. 25-33.

Experimental data regarding longitudinal and transverse expansion and contraction in welded structures. The data concerning the former are not interpreted, but the latter type is thoroughly studied because of its greater effect upon practical work. Hopes that the concept of stabilized contraction which is presented will permit more thorough analysis of factors involved.

**22-681. "UONI-13" Electrodes.** K. V. Petran', N. M. Kizin, and A. P. Bibikov. *Avtogennoe Delo (Welding)*, Aug. 1947, p. 4-9. (In Russian.)

Composition of the coating, properties of the deposited metal, and technology of the preparation of the above electrodes.

**22-682. A Method of Estimating the Amount of Coating on an Electrode.** A. A. Erokhin. *Avtogennoe Delo (Welding)*, Aug. 1947, p. 10-13. (In Russian.)

A coefficient of the ratio of the weight of coating to the weight of the metal taking part in the process is proposed as a criterion for estimating the quantity of coating. This ratio is shown to be nearly constant for different sizes of electrodes having coatings of the same composition.

**22-683. Differential Means of Determining Stresses.** N. N. Prokhorov. *Avtogennoe Delo (Welding)*, Aug. 1947, p. 20-22. (In Russian.)

Method proposed permits analyzing the stress state of the metal during the entire welding cycle.

**22-684. Earthen Forms for Welding Fabrication Cutting Tools.** Z. M. Ryzhik. *Avtogennoe Delo (Welding)*, Aug. 1947, p. 27. (In Russian.)

Use of special forms in factory production of cutting tools with hard metal tips applied by fusion welding to the bodies of the tools.

**22-685. Manipulator for Assembly and Welding of Crossbeams of Tension Frames.** N. I. Kazakov. *Avtogennoe Delo (Welding)*, Aug. 1947, p. 27-28. (In Russian.)

Technique of welding tension girders and construction of a handling tool to facilitate such operations.

**22-686. On the Welding Deposition of Antifriction Alloys by Metallic Electrodes.** L. P. Pankul. *Avtogennoe Delo (Welding)*, Aug. 1947, p. 29. (In Russian.)

Process used for bronze surfacing of shafts and bushings by welding, especially as applied to locomotives.

**22-687. Correction of the Power Factor of Welding Machines by Condensers.** M. D. Genkin. *Engineers' Digest (American Edition)*, v. 4, Oct. 1947, p. 486-489.

The low power factor of spot welding machines and the heavy intermittent current demands are difficult to meet on most distribution networks Use of static condensers in series rather than in parallel and fundamental calculations for such circuits. (Translated and condensed from *Bulletin de la Societe Francaise des Electriciens*, v. 6, Dec. 1946, p. 645-653.)

**22-688. The Ellira Welding Process.** W. Rädeker. *Engineers' Digest (American Edition)*, v. 4, Oct. 1947, p. 475-478.

Data on process, which is known as the submerged arc or unionmelt process, both in the U. S. and in Great Britain. (Translated and condensed from *Stahl und Eisen*, v. 66-67, Jan. 30, 1947, p. 42-48.)

**22-689. Heliarc and Argonarc Welding.** R. Groves. *Machinery Lloyd (Overseas Edition)*, v. 19, Oct. 25, 1947, p. 79-83.

Equipment, procedures, and applications.

**22-690. Welding Metallurgy. Recent Progress in the Nonferrous Alloy Field. (Continued.)** J. G. Gall. *Metal Industry*, v. 71, Oct. 17, 1947, p. 319-322; Oct. 24, 1947, p. 345-346, 348; Oct. 31, 1947, p. 367-369.

Of magnesium alloys, and mechanical and structural properties of welds made of nonarsenical deoxidized copper containing various amounts of phosphorus. (To be continued.)

**22-691. Methods of Joining Pipe—Welded and Brazed Pipe Joints.** J. E. York. *Heating and Ventilating*, v. 44, Nov. 1947, p. 99-101.

Advantages and limitations of each. Common forms of welds and fittings.

**22-692. Resistance Welding.** R. T. Gillette. *Materials & Methods*, v. 26, Nov. 1947, p. 97-108.

Materials that can be resistance welded, resistance-welding equipment and control. 28 ref.

**22-693. How to Maintain Spot Welders.** Fritz Albrecht. *Factory Management and Maintenance*, v. 105, Nov. 1947, p. 84-88.

Weld-testing procedures and their use, not only for quality control but also to indicate necessity for maintenance work on welding machines.

**22-694. Welding for Coal Preparation.** Harold D. Larner. *Industry and Welding*, v. 20, Nov. 1947, p. 26-29, 74-75.

Cutting and welding operations in fabrication of coal-preparation equipment.

**22-695. Practical Applications of Toolsteel Welding.** Norman Anderson. *Industry and Welding*, v. 20, Nov. 1947, p. 30-32, 59-61.

Equipment, grinding, preheating, control of temperature, composite dies, and the welding of various types of toolsteel.

**22-696. Repair, Maintenance, Fabrication in the Plant Weldery. No. 14. The Dow Chemical Co., Midland, Mich.** *Industry and Welding*, v. 20, Nov. 1947, p. 40-42, 44, 46.

**22-697. Electric Welding.** *Railway Mechanical Engineer*, v. 121, Nov. 1947, p. 623-624.

Inert-gas shielding for arc welding, atomic-hydrogen welding, and automatic welding heads.

**22-698. Fabricating Hand Trucks by Welding.** Karl Stad. *Tool Engineer*, v. 19, Nov. 1947, p. 42.

How a production problem was solved by use of the right electrode.

**22-699. Jig and Fixture Economics; the Importance of Efficient Clamping.** B. R. Pyke. *Sheet Metal Industries*, v. 24, Nov. 1947, p. 2250, 2257.

Superiority of the toggle clamp over the old type plate clamp and its accessories in setting up for welding.

**22-700. A Brief Review of Brazing Processes. (Continued.)** H. R. Brooker. *Sheet Metal Industries*, v. 24, Nov. 1947, p. 2253-2256.

Design considerations; joint strength; preparation for brazing; and torch brazing. (To be continued. Presented at Autumn Conference of Sheet and Strip Metal Users' Technical Assoc.)

**22-701. The Welding of Nonferrous Metals. Part IX. (Continued.)** E. G. West. *Sheet Metal Industries*, v. 24, Nov. 1947, p. 2265-2271.

Weldability of different nickel-base materials and the different procedures used. (To be continued.)

**22-702. The British Welding Research Assoc.'s Symposium on the Welding of Light Alloys; Aluminum Alloys for Gas Welding With Special Reference to Aluminum-Silicon-Copper Alloys. (Continued.)** J. Pendleton and A. G. Liddiard. *Sheet Metal Industries*, v. 24, Nov. 1947, p. 2273-2278, 2280.

Discusses results presented in first installment. Welding behavior of the various alloys. Charts show hardness gradients across welds made in different ways and with different pretreatments and post-treatments. Mechanical properties and heat treatment of 5% Si, 2½% Cu, aluminum alloy in sand-cast and wrought conditions.

**22-703. Welding in the U. S. Aircraft Industry.** R. Grimaud. *Aircraft Engineering*, v. 19, Oct. 1947, p. 331-333; Nov. 1947, p. 361-365. (Translated from the French.)

A French production engineer's

*(Turn to page 38)*

# Market Analysis Essential to Steel Industry's Planning

Reported by Hans J. Heine
*Chief Metallurgist*
*Pittsburgh Equitable Meter Div.*
*Rockwell Mfg. Co.*

The importance of market analyses in the steel industry's long-range business plans was stressed by Francis Juraschek, manager of the commercial research division of Carnegie-Illinois Steel Corp., before the Pittsburgh Chapter on Nov. 13. The occasion was one that has now become an eagerly anticipated institution of the chapter — namely, the ninth annual Young Fellows' Night.

Speaking on "Knowledge of Markets, the Key to Industrial Planning", Mr. Juraschek pointed out that "without an adequate knowledge of market conditions, plans for the future must be based on something less than thin air." He then defined what is meant by a knowledge of industrial markets and explained the methods which are employed to develop and organize this knowledge. "In contrast to the marked technological progress which the steel industry has enjoyed for the past 50 years", he said, "similar progress in lowering the cost of distribution has not been made."

Mr. Juraschek continued by developing a case study of the principles involved in applying the knowledge of market research to the problem of extracting a reasonable profit from the sale of industrial material and equipment.

Norman I. Stotz, president of Braeburn Alloy Steel Corp., acted as discussion leader, and Johnny Mock, outdoors editor of the Pittsburgh *Press*, discussed the "Life of a Rod and Gun Editor" as a coffee talk.

Orchids are due the members of the Young Fellows' Night Committee: Messrs. L. A. Hauser, chairman; E. W. Kempton, vice-chairman; A. Feduska, E. Landerman, E. A. Loria, J. J. Marsalka, H. B. Myers, J. T. Ransom, C. M. Reed, J. P. Riott, J. K. Stanley, A. Squire and C. H. Wilkins.

# X-Rays Solve Problems In Metallographic Fields

Reported by H. J. Reindl
*Metallurgist, Inland Mfg. Division, G.M.C.*

Practical and theoretical aspects of X-ray metallography were outlined for the Dayton Chapter by Charles S. Barrett, professor, Institute for the Study of Metals, University of Chicago, at the Nov. 12th meeting.

That X-rays are a remarkably flexible tool for revealing the internal constitution and structure of metals was shown by Dr. Barrett. They bring to light details that exist on a macroscopic, microscopic, atomic, and even a subatomic scale. For some kinds of work, Dr. Barrett pointed out, X-rays are the only suitable tool, while there are other applications in which X-rays have strong or superior competitors.

Slides were used to illustrate various applications, particularly in the fields of inspection, plastic deformation, age hardening, and phase transformations, where X-rays have been unusually successful. Some of the newer developments that have potentialities for the future were also discussed.

Following the lecture an informal discussion of various metallurgical problems and their possible solution by the use of X-rays took place.

## Vitt Joins John Ek Industries

George N. Vitt, member of the New Haven Chapter, resigned on Dec. 3 from his position of assistant to the president of the A. F. Holden Co., New Haven, Conn., to become the secretary, member of the board of directors and manager of the John Ek Industries, Inc., Guilford, Conn.

The Crown Chemical Division of the John Ek Industries will produce a complete line of heat treating salt baths, furnaces and complete automatic installations for various metallurgical processes. Other divisions are engaged in design and manufacture of industrial internal combustion engines and several precision items.


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views on the position of welding in America.

**22-704. Flame Cut Stainless Steel (Arcos Oxyarc Process).** *Weld*, v. 3, Nov. 1947, p. 10-11.

Examination of four samples of stainless plate and one of stainless bar indicates that the extent of carbide precipitation caused by the cutting operation will vary with the thickness of the material being cut and possibly with the technique employed by the operator.

**22-705. Intercrystalline and Other Types of Corrosion of Steam Boilers.** *American Railway Engineering Association Bulletin*, v. 49, Nov. 1947, p. 66-67.

Committee report indicates that all-welded construction should result in a satisfactory boiler, free of seams which facilitate concentrations of dissolved solids contributing to intercrystalline corrosion.

**22-706. Automatic Welders Increase Trailer Body Output—Cut Costs.** *Modern Industrial "Press"*, v. 9, Nov. 1947, p. 6.

**22-707. Hydrogen Brazing Seals Evaporator Plates.** *Refrigerating Engineering*, v. 54, Nov. 1947, p. 443, 479.

Procedures and equipment used for joining two sheets, one of which is embossed to form channels for passage of refrigerant.

**22-708. New Lock Joint Speeds Assembly, Adds Rigidity.** *Sheet Metal Worker*, v. 38, Nov. 1947, p. 61.

New spring-construction lock joint recently developed in England permits better design and overcomes disadvantages of rigid assemblies using screws, rivets, or welded construction.

**22-709. Types of Modern Wire Welding Equipment. Part II.** *Wire Industry*, v. 14, Nov. 1947, p. 621-624.

Additional general purpose and specialized machines. (To be continued.)

**22-710. Mechanized Inert-Gas Shielded-Arc Welding.** H. T. Herbst. *Modern Metals*, v. 3, Nov. 1947, p. 28-32.

Adopted from paper presented at meeting of American Welding Society, Chicago, Oct. 1947.

**22-711. Precision Pressure Regulation of Various Gases.** J. K. Hamilton. *Welding Journal*, v. 26, Nov. 1947, p. 977-983.

The pressure-control phase of an oxy-fuel gas process; design of suitable equipment to meet these requirements. Some of the problems involved in pressure control for welding. (Presented at 28th Annual Meeting, American Welding Society, Chicago, Oct. 19. 1947.)

**22-712. On-the-Ground Welded Fabrication of Studding Speeds Construction of All-Steel Three-Story Office Building.** R. H. Newton. *Welding Journal*, v. 26, Nov. 1947, p. 984.

**22-713. Structural Dead Weight Eliminated in Construction of Four-Story, All-Welded Steel Building.** E. D. Anderson. *Welding Journal*, v. 26, Nov. 1947, p. 985-987.

**22-714. D. L. & W. 50-Ton Hopper Cars.** W. C. Osha. *Welding Journal*, v. 26, Nov. 1947, p. 991-993.

Construction at American Car and Foundry Co.; welding procedures.

**22-715. Pressure Welding Propeller Barrels.** G. W. Motherwell, A. L. Rustay, S. M. Jablonski, and C. J. Burch. *Welding Journal*, v. 26, Nov. 1947, p. 994-1001.

Development of a satisfactory fabrication procedure for barrels of S.A.E. 4345 alloy steel. The experimental program consisted of three parts: pressure welding of S.A.E. 4345 steel and pressure welding of barrels; design of production equipment; establishment of procedures and controls for quality and quantity production.

**22-716. Welding of Locomotive Type High Pressure Boilers.** George M. Trefts, 3rd. *Welding Journal*, v. 26, Nov. 1947, p. 1011-1014.

Presented at 25th Annual Meeting, American Welding Society, Chicago, week of Oct. 19, 1947.

**22-717. New Developments in Railroad Maintenance-of-Way Work.** C. A. Daley. *Welding Journal*, v. 26, Nov. 1947, p. 1015-1017.

Uses of the oxy-acetylene torch include: building up of wheel burns in rail; flame crowning or straightening of joint bars; flame hardening of openhearth steel frogs; flame shortening of eyebars to equalize stresses; butt welding of rails; flame cropping of rails; and flame cleaning of bridges and steel structures. (Presented at 28th Annual Meeting, American Welding Society, Chicago, week of Oct. 19, 1947.)

**22-718. The Heat Treatment of Spot Welds in Steel Plate.** W. F. Hess, W. D. Doty, and W. J. Childs. *Welding Journal*, v. 26, Nov. 1947, p. 641s-652s.

Investigation shows that it is possible to perform in the welding machine all the common metallurgical heat treatments including grain refining, tempering, and austempering. Electronic equipment gives automatic control of the entire welding and heat treating sequence. It is also possible to follow and record the temperature of the weld during the process, permitting accurate establishment of the proper welding conditions.

**22-719. Studies on the Effects of Red-Lead Paints on the Quality of Metal-Arc Welds in Structural Steel.** R. W. Bennett, R. D. Williams, and C. B. Voldrich. *Welding Journal*, v. 26, Nov. 1947, p. 653s-663s.

Effects of red-lead paints on welding compared with those of zinc-chromate paints and unpainted steel. Operating characteristics of the electrodes, internal soundness of the weld metal, and mechanical tests were used as criteria for evaluating the relative effects. In general, satisfactory welds can be expected on steel with shop or field coats (nominal thickness of about 1 mil), of all the paints tested. (Presented at 28th Annual Meeting, American Welding Society, Chicago, week of Oct. 19, 1947.)

**22-720. The Flash Welding of Structural Aluminum Alloys.** R. M. Curran and R. C. Becker. *Welding Journal*, v. 26, Nov. 1947, p. 664s-672s.

Two relatively new concepts have been introduced—first, the use of three-stage heat control during the welding cycle, and second, the use of much greater upset travel distances for aluminum alloys than is the practice in flash welding other materials. Need for an investigation of thermal cycles and temperature gradients associated with flash-welding. (Presented at 28th Annual Meeting, American Welding Society, Chicago, Oct. 19, 1947.)

**22-721. Some Additional Tests on the Lehigh Restraint Specimen.** R. D. Stout, S. S. Tor, L. J. McGeady, and G. E. Doan. *Welding Journal*, v. 26, Nov. 1947, p. 673s-682s.

A test specimen to determine the crack sensitivity of welds was used to investigate various factors such as: heats of high-tensile steel, effect of preheating low and high crack-sensitive steels; temperature at which root cracks form in the weld metal or heated zone of butt welds; and influence of electrode and welding conditions on contour and penetration of welds as related to cracking tendency.

**22-722. Metallurgical Factors in the Embrittlement of Welded Plate.** R. D. Stout and L. J. McGeady. *Welding Journal*, v. 26, Nov. 1947, p. 683s-692s.

Causes of impairment of notch resistance and ductility of structural steel by welding. Under external loading, cracking is shown to originate in the intergranular structure of the coarse grains in the weld-heated zone. Resistance to crack propagation is adversely affected by the notch sensitivity of that steel structure which is heated within the critical range of the steel. If pretreatment is performed by quenching and drawing or spheroidizing, the sensitivity of the steel to intercritical temperatures is greatly lessened. Localized gas-torch post-heating may be an easy and practical way of restoring the properties of the welded plate.

**22-723. Metal-Arc Transfer as Influenced by Some Materials in the Covering of Welding Electrodes.** C. T. Gayley. *Welding Journal*, v. 26, Nov. 1947, p. 693s-704s.

Effect of the basicity of the covering formula on the metal arc transfer of some of the common alloying elements that may be present in the covering, and recovery of the elements in the core wire. Effect of particle size of ferro-alloys on their recovery.

**22-724. Welding Metallurgy.** J. G. Ball. *Metal Industry*, v. 71, Nov. 7, 1947, p. 385-386, 389.

Recent progress in the nonferrous alloy field; microstructure and mechanical properties of welds in copper alloys.

**22-725. Automatic Joining Method.** Gerald Eldridge Stedman. *Steel*, v. 121, Nov. 17, 1947, p. 106, 108.

Method involving horizontal arc welding turns out petroleum tanks on production-line basis.

**22-726. Engineering Aspects of Bolt Variables.** V. E. Hillman. *Iron Age*, v. 160, Nov. 20, 1947, p. 62-68.

Functions and limitations of bolts and nuts; suggestions for obtaining better results from bolted assemblies. Procedures for determining tension induced during tightening; variables such as machining, heat treatment, and steel analysis. A table on defects in screw threads and their causes.

**22-727. New Procedures in Stainless Fabrication Evolved by Combined Use of Flame Cutting and Welding.** *Steel*, v. 121, Nov. 24, 1947, p. 89-90.

Application of dry nonmetallic flux, carried by the oxygen stream, to construction of a 12-ft. stainless and nickel-clad base for a Dilts Hydrapulper.

**22-728. Hard Faces Live Long.** H. R. Clauser. *Scientific American*, v. 177, Dec. 1947, p. 255-257.

Application of a coat of wear resistant alloy to a base of less durable metal results in parts that give high-alloy performance without high-alloy costs.

**22-729. Oxy-Acetylene Powder Cutting and Scarfing.** D. H. Fleming, Jr. *Steel*, v. 121, Dec. 1, 1947, p. 96-97, 120, 123, 126.

How the powder-cutting reaction overcomes difficulties encountered in cutting oxidation resistant metals. Production applications to stainless steel, cast iron, and nickel-base alloys.

**22-730. Welding of Ore Bridge Effects Dead Weight Reduction.** *Steel*, v. 121, Dec. 1, 1947, p. 98.

**22-731. Motor Frames Welded by Submerged-Arc.** J. B. Arthur. *American Machinist*, v. 91, Dec. 4, 1947, p. 106-109.

Use of specially built machine and fixtures in fabrication of motor frames on a mass-production basis at new Westinghouse plant.

**22-732. Fine Wires Can Be Welded.** R. T. Gillette. *Welding Engineer*, v. 32, Dec. 1947, p. 42-43, 47.

Welding of wires ranging from 0.0005 to 0.060 in. Metals involved are copper, iron, silver, gold, platinum, tantalum, tungsten, molybdenum, iridium, nickel, palladium, and their alloys.

**22-733. Heavy-Duty Trailer Production.** Walter Rudolph. *Welding Engineer*, v. 32, Dec. 1947, p. 54-57.

Welding fabrication procedures.

*(Turn to page 40)*

# Mechanical Testing Indispensable to Improved Products, Focke Tells Home Chapter

*National Officers Entertain Indianapolis Executive Committee at Luncheon, Dec. 15. Those present, left to right, are: J. W. Watson, chapter secretary; T. G. Harvey; R. H. Stewart, treasurer; J. G. Worthington, vice-chairman; J. C. Skinner; National Secretary Eisenman; A. J. Newsom, chapter chairman; National Trustee Arthur Focke; J. G. Frantzreb; P. F. Ulmer; J. S. Blay; A. H. Barton; and G. W. Bauer*

Reported by John Watson
*Metallurgist, Link-Belt Co.*

How the results of mechanical testing can be applied to make better mechanical parts and assemblies was demonstrated by Arthur Focke, chief metallurgist of Diamond Chain Co., before the December meeting of his home chapter in Indianapolis. The occasion was National Officers' Night, and Secretary W. H. Eisenman shared the speaker's platform with Dr. Focke, who is a national trustee of the society.

Mechanical testing, said Dr. Focke, is indispensable in the metallurgist's quest for new materials, new processes, and improved designs. In attempting to produce a better product at lower cost, it is not always wise to try a theoretically superior product in production, since only one service failure may destroy customer acceptance built up by many years of reliable performance. A change may also bring an increased number of rejects after processing, which could increase rather than reduce costs.

To duplicate service conditions exactly in testing is difficult, Dr. Focke emphasized. Simplifying the test, but applying factors to correct for service conditions, is an alternate procedure which has great merit when the applied factors are correct.

Static tests as applied to roller chain —a major product of the speaker's company—are necessary to test its over-all character. The tensile test is still the most widely used single test. Holding power of bushings in inside plates, and of pins in outside plates, is a frequently made test. Compressive strength of rollers and bushings is determined to show something of their quality.

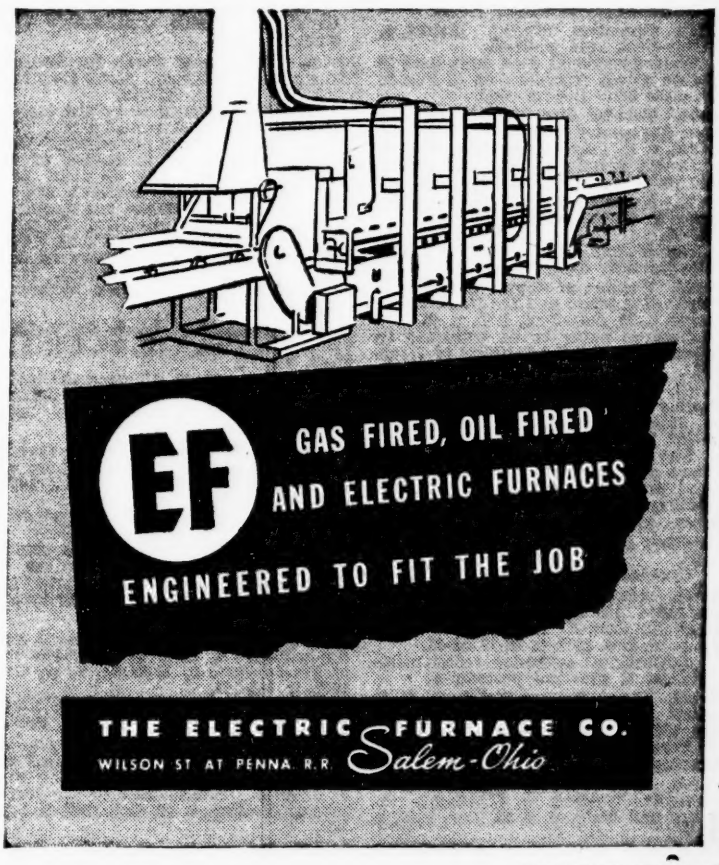
Dynamic tests give final indication of the quality of the product. These include determination of fatigue strength and ability to withstand wear or high speed.

Dr. Focke reviewed the methods which may be used to develop superior design of load-carrying members by stress analysis. Cohesive strength and flow strength may be used to explain the mechanism of the failure of metals under complex stress distributions.

The speaker expressed the hope that a greater familiarity with elementary concepts will encourage more metallurgists to study and apply these developments of "mechanical metallurgy". The metallurgist may then escape the ignominious engineering classification of "overambitious chemist" or "overpaid tool hardener".

**Ryerson Enlarges Warehouse**

New offices and a large addition to the existing warehouse facilities in Cleveland have been completed by Joseph T. Ryerson & Son, Inc., Chicago, distributors of steel from stock. The new building provides 80,000 additional sq.ft. of heated warehouse space and approximately 13,000 sq.ft. of space for offices, bringing the floor area of the entire property to a total of about 250,000 sq.ft.

**22-734. Flash-Welded Draft Gear.** *Welding Engineer*, v. 32, Dec. 1947, p. 58, 60.

Production of new weld-fabricated housing for these gears, which were formerly assembled from cast-steel parts.

**22-735. Advanced Techniques for Pressure Vessels.** Gerald Eldridge Stedman. *Welding Engineer*, v. 32, Dec. 1947, p. 36-40.

Several techniques developed by Goslin-Birmingham Mfg. Co., Birmingham, Ala.

**22-736. Welded Pipe Line "Down Under".** J. M. C. Corlette and W. S. Smallman. *Welding Engineer*, v. 32, Dec. 1947, p. 44-47.

Construction of 54-in., mild-steel water line in Australia.

**22-737. Crowd Gear Gets a New Set of Teeth.** *Welding Engineer*, v. 32, Dec. 1947, p. 52-53.

Welding repair of teeth on large cast-iron gear for English-made power shovel.

**22-738. Problems in Pipe Fitting.** *Welding Engineer*, v. 32, Dec. 1947, p. 51.

Installation of pipe lines in Cleveland Clinic addition which called for many varied applications of welding.

**22-739. Comparisons in Welding Between the Old and New Aircraft Carriers "Ark Royal".** *Welder*, v. 16, July-Sept. 1947, p. 51-54.

Constructional details.

**22-740. Tensile Impact Tests on Welds at Low Temperatures.** Otto H. Henry. *Aluminium and the Non-Ferrous Review*, v. 12, July-Sept. 1947, p. 52.

Test results on aluminum alloy welds as described in B. S. theses of George L. McFarland, Jr., and George P. De Rosa at Polytechnic Institute of Brooklyn.

**22-741. A 12-Ton Mobile Excavator Crane.** *Welder*, v. 16, July-Sept. 1947, p. 55-57.

Construction of welded crane.

**22-742. Operation "Shark".** *Welder*, v. 16, July-Sept. 1947, p. 57-62.

Welded sectional dock units used to insure speedy rehabilitation of French seaports after the invasion.

**22-743. Tubular Steel Roof Trusses for Arcon Temporary Prefabricated Houses.** *Welder*, v. 16, July-Sept. 1947, p. 63-66.

Design details and jigging method for welding assembly.

**22-744. Repairs to U.S. S.S. "American Farmer".** *Welder*, v. 16, July-Sept. 1947, p. 68-71.

Repair procedures for ship which was seriously damaged by collision.

**22-745. Welding of Copper and Copper Alloys.** *Aluminium and the Non-Ferrous Review*, v. 12, July-Sept. 1947, p. 66.

Outlines paper to be published in *Transactions of the Institute of Welding.*

**22-746. How to Select Mild Steel Arc Welding Electrodes.** H. O. Westendarp, Jr. *Steel Processing*, v. 33, Nov. 1947, p. 679-680, 703.

The more important welding conditions and requirements, and the general procedures recommended for selecting the best electrode for the job.

**22-747. Stud Welding.** *Machinery Lloyd (Overseas Edition)*, v. 19, Nov. 8, 1947, p. 93-95.

Cyc-Arc system.

**22-748. Advantages and Applications of Controlled Atmosphere Copper Brazing.** Frank Humberger. *Industry and Welding*, v. 20, Dec. 1947, p. 26-29, 58-61.

Advantages; suggested redesign applications; practical procedures.

**22-749. Flame Cutting Stainless.** G. E. Bellew. *Industry and Welding*, v. 20, Dec. 1947, p. 30-31, 34.

Some applications of flux-injection method.

**22-750. Commercial Applications of Argon-Arc Welding.** J. L. Adams. *Industry and Welding*, v. 20, Dec. 1947, p. 36-38.

Several applications and further possibilities for use on such alloys as stainless, Inconel, everdur, copper, and cast iron.

**22-751. Welded Design Takes the Shock.** *Industry and Welding*, v. 20, Dec. 1947, p. 40-42, 63-64.

Production of welded draft gears for absorbing freight-car shocks. Submerged-arc welding, induction heating, and automatic flash welding used.

**22-752. Designing for Resistance Welding.** Ernie Lauter. *Industry and Welding*, v. 20, Dec. 1947, p. 54-55.

**22-753. 700 Pipe Flanges per Month Are Salvaged on Beveling Machine Built From Scrap.** Vernon Starr. *Petroleum Processing*, v. 2, Dec. 1947, p. 918.

Use of home-made beveling machine. Flame-cutting technique.

**22-754. Soldered Ceramic-to-Metal Seals.** A. L. Jenny. *Product Engineering*, v. 18, Dec. 1947, p. 154-157.

Design of a relatively simple and little-known type of gasketless seal for making gas-tight joints between ceramic and metal.

**22-755. Spot Welded Aluminum Components Designed for Repeated Loads.** Robert C. McMaster and Horace J. Grover. *Product Engineering*, v. 18, Dec. 1947, p. 158-161.

Results of two separate series of tests, one to investigate the effect of spot welded connections on the static and fatigue strength of stiffened panels in compression and the other for the effect of spot welds joining stressed and unstressed attachments to tension members.

**22-756. Aluminum Strips Butt Welded for Cyclotron Magnet Coil.** I. A. Oehler. *Iron Age*, v. 160, Dec. 4, 1947, p. 80-83.

Some 1700 50-ft. lengths of aluminum strip of 5/16x4-in. cross section were butt welded to form the field coils of the new cyclotron at the University of Rochester, using a standard flash welder with continuously fed strip.

**22-757. Ductility of Steels for Welded Structures.** A. B. Kinzel. *Metal Progress*, v. 52, Nov. 1947, p. 795-799.

Ductility is shown to be the essential factor involved in weldability. The various test methods are critically discussed and results of testing of 15 commercial steel heats (5 plain carbon, 6 low-alloy structural, and 4 engineering alloy steels) are summarized. Gives recommendations for testing under practical conditions. (To be published in *Transactions of the American Society for Metals, 1948.* Condensed from Campbell Memorial Lecture.)

**22-758. Ductility of Steels for Welded Structures.** *Steel*, v. 121, Dec. 8, 1947, p. 91-92, 108, 111.

Presents results of research sponsored by Union Carbide and Carbon Research Laboratories. (See item 22-757.)

**22-759. Development of Welding Standards.** A. F. B. Nall. *Transactions of the Institute of Welding*, v. 10, Oct. 1947, p. 138-140.

Procedure followed in the preparation of British standards. Some of the arguments for and against standards; standardization in relation to the welding industry in particular. Organization of the British Standards Institution, Welding Section.

**22-760. Stud Welding Development and Application.** A. H Bent. *Transactions of the Institute of Welding*, v. 10, Oct. 1947, p. 141-145.

Stud-welding technique in a plant making rectified transformer equipment.

**22-761. Ship Welding as Practiced on the River Wear.** R. C. Thompson and J. P. Allan. *Transactions of the Institute of Welding*, v. 10, Oct. 1947, p. 146-148.

**22-762. Investigation of the Strength of Bronze Welded Joints.** M. S. Fisher and H. Brooks. *Transactions of the Institute of Welding*, v. 10, Oct. 1947, p. 149-160.

Bronze welded joints in various types of steel were tested mechanically and examined microscopically. Suitable types have about the same static strength as similar oxy-acetylene fusion welds but are not quite so strong as arc welds.

**22-763. Radiographing and Controlled Low-Temperature Stress Relieving of Welded Tanks for Wet Seal Gas Holder.** Rudolf Kraus. *Welding Journal*, v. 26, Dec. 1947, p. 1073-1079.

Procedures for a tank 38 ft., 2 in. high and 276 ft., 6 in. in diameter of steel 1/2 to 1 7/8 in. thick, the largest welded tank in the world. (Presented at the 28th Annual Meeting, American Welding Society, Chicago, week of Oct. 19, 1947.)

**22-764. Submerged Melt Welding of Hardenable Steels.** E. A. Clapp and E. L. Frost. *Welding Journal*, v. 26, Dec. 1947, p. 1079-1082.

Control of cooling rates of welded assemblies as affected by preheat temperatures and welding conditions. Use of isothermal-transformation-curve data to determine proper preheat and postheat temperatures is recommended. (Presented at 28th Annual Meeting, American Welding Society, Chicago, week of Oct. 19, 1947.)

**22-765. Welding in Assembly Line Production of Refrigerator Cabinets.** P. Bowman. *Welding Journal*, v. 26, Dec. 1947, p. 1083-1086.

Presented at 28th Annual Meeting, American Welding Society, Chicago, week of Oct. 19, 1947.

**22-766. Design of Arc Welded Steel and Its Relation to Costs.** R. H. Davies. *Welding Journal*, v. 26, Dec. 1947, p. 1087-1090.

Presented at 28th Annual Meeting, American Welding Society, Chicago, week of Oct. 19, 1947.

**22-767. White Metal Welding.** A. E. Speck. *Welding Journal*, v. 26, Dec. 1947, p. 1091-1093.

Methods which can be successfully used for white or die-cast metal by welding shops, garages, and automobile repair shops.

**22-768. Electric Arc Stud Welding.** Robert C. Singleton. *Welding Journal*, v. 26, Dec. 1947, p. 1095-1101.

Equipment, techniques, applications, and metallurgical aspects. Results of mechanical testing of such welds. (Presented at 28th Annual Meeting, American Welding Society, Chicago, week of Oct. 19, 1947.)

**22-769. Welded Plate Buggies Save Time on Tank Construction.** Max Alth. *Welding Journal*, v. 26, Dec. 1947, p. 1118.

Time and cost-saving technique used in constructing storage tanks.

**22-770. Automatic Welders Increase Trailer Body Output.** *Welding Journal*, v. 26, Dec. 1947, p. 1128.

**22-771. Static and Fatigue Strengths of Welded Joints in Aluminum-Manganese Alloy Sheet and Plates.** R. L. Templin and Marshall Holt. *Welding Journal*, v. 26, Dec. 1947, p. 705s-711s.

Results of extensive investigations involving Alcoa 35 sheet and plate.

**22-772. A Study of Projection Welding.** W. F. Hess and W. J. Childs. *Welding Journal*, v. 26, Dec. 1947, p. 712s-723s.

Effects of projection size, weld time, electrode force and welding current on weld formation, using A.I.S.I. 1010, 1015, and 1020 steel in 0.062 and 0.125-in. thicknesses. (Presented at 28th Annual Meeting, American Welding Society, Chicago, week of Oct. 19, 1947.)

**22-773. Some Factors Controlling the Ductility of 25% Cr, 20% Ni Weld Deposits.** O. R. Carpenter and N. C. Jessen. *Welding Journal*, v. 26, Dec. 1947, p. 727s-740s; discussion, p. 740s-741s.

*(Turn to page 42)*

# Steelmaking Studied In Pilot-Size O.H.

Reported by Louis Malpoker
*Lincoln Engineering Co.*

Experimental steelmaking in the pilot-size openhearth furnace was described by Harold K. Work, director of research of the Jones and Laughlin Steel Corp., before the St. Louis Chapter ⚙, at its Nov. 21st meeting. Dr. Work also discussed the bessemer and duplex methods.

A diagram of the pilot-size openhearth furnace was shown and explained by Dr. Work. The furnace originally was designed for a capacity of 1500 lb., which later was increased to 8000 lb. The acid roof used initially was replaced with a basic roof that proved very satisfactory. Dr. Work also told of problems encountered with the recuperator, which were eliminated by relocating some of the tubes. The present furnace has been in use for nine years and over 700 heats have been made during that time.

Total charging time is approximately 1¾ hr. Carbon content of the heat is checked with a Carbanalyzer and the heat is tapped when the carbon content has dropped to the desired point. There is no slag run-off and in order to control phosphorus, iron oxide is often added. Sulphur gives very little trouble in this furnace. Heats are ready to tap 5 min. after the final addition.

A diagram was then shown in which tensile strength, yield point, elongation and reduction of area were compared for research heats and mill heats. The properties were very similar.

Dr. Work then told of experiments with the bessemer converter. Steel made by the bessemer method is hard and brittle in cold working, because of high nitrogen content. Nitrogen can be held to a minimum by the duplex method. Slides were presented to show the effects of oxygen and nitrogen content upon the properties of various steels. Dr. Work also pointed out that other elements besides nitrogen may affect sensitivity to cold work.

### Permanente Purchases Plant

A new aluminum reduction plant which will add an estimated 3½ million pounds of aluminum pig per month to the production potential of the Permanente Metals Corp. was opened at Tacoma, Wash., on Oct. 31. The plant was purchased from the Defense Plant Corp. for $3,000,000 last December, and an additional $1,000,000 has been spent in preparing it for operation.

The Tacoma plant will supplement Permanente's aluminum pig production at the Mead plant near Spokane.

# Prominent Guests Attend Philadelphia Officers' Night

Reported by Howard J. Godfrey
*Assistant Chief Development Engineer*
*John Roebling's Sons Co.*

On Nov. 28, National Officers' Night, 250 members of the Philadelphia Chapter ⚙ honored Francis B. Foley, past chairman of the Philadelphia Chapter and present national president of A.S.M. The highlight of the evening was the presentation of a beautiful, engraved silver bowl to Mr. Foley by Chapter Chairman Howard F. Casey, Jr. After a few entertaining remarks from National Secretary Bill Eisenman, Mr. Foley presented a very interesting paper on "Alloys for High Temperature Service".

A reception for the national officers was held prior to the dinner meeting. Among the honored guests were three past presidents of A.S.M., namely, William B. Coleman, Bradley Stoughton and Albert E. White. H. Bodfish, chairman of the Baltimore Chapter, and R. L. Deilly, chairman of the Lehigh Valley Chapter, were also present. John L. Cox, retired chief engineer of the Midvale Co., was on hand to honor his former associate, Mr. Foley. The meeting was a fine tribute to our national president, who expressed his heartfelt thanks for his chapter's support.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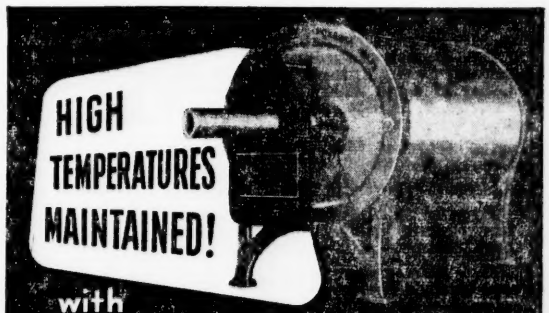


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**Effects of varying amounts of carbon, manganese, and silicon on weld ductility as determined on different heats of core wire, and application of the data to the specifying of a core-wire analysis which will produce a minimum of microdefects in deposited 25% Cr, 20% Ni welds.** (Presented at 28th Annual Meeting, American Welding Society, Chicago, week of Oct. 19, 1947.)

**22-774. Effect of Manganese and Molybdenum on the Microstructure and Mechanical Properties of Low-Alloy Ferritic Weld Metal.** William G. Benz, Jr. *Welding Journal*, v. 26, Dec. 1947, p. 742s-748s.

Results of investigation.

**22-775. Flame Deseaming.** Fred Judelsohn. *Iron and Steel Engineer*, v. 24, Dec. 1947, p. 51-53; discussion, p. 53-54.

Cost advantages on steel plate, particularly where defects are deep or where 100% skinning is necessary. (Presented at A.I.S.E. Philadelphia District Section Meeting, Dec. 7, 1946.)

**22-776. A Brief Review of Brazing Processes. (Continued.)** H. R. Brooker. *Sheet Metal Industries*, v. 24, Dec. 1947, p. 2457-2462; discussion, p. 2462-2466.

Procedure for torch brazing; heating by fixed torches; furnace brazing; induction brazing; dip brazing; salt-bath brazing; and brazing of aluminum. (To be continued. Presented at Autumn Conference of the Sheet and Strip Metal Users' Technical Association.)

**22-777. The Metallurgical Aspects of Fusion Welding in Relation to the Weldability of Steels.** H. Granjon. *Sheet Metal Industries*, v. 24, Dec. 1947, p. 2475-2477.

Changes observed on heating and on cooling, and determination of weldability. (To be continued.)

**22-778. Discussion of Technical Papers on the Development of Strong Aluminum Alloys for Welding; Presented at the First Session of the British Welding Research Assoc. Symposium on the Welding of Light Alloys.** *Sheet Metal Industries*, v. 24, Dec. 1947, p. 2484-2488, 2490.

**22-779. Stainless Steel Piping; Fabrication by Welding.** *Heating, Piping & Air Conditioning*, v. 19, Dec. 1947, p. 73-78.

Preparation of stainless pipe joints for welding, welding processes, and heat treatment after welding.

**22-780. Phonograph Turntables Produced by High Production Welding With Battery Welders.** *Tool and Die Journal*, v. 13, Dec. 1947, p. 100.

**22-781. Brazing Stages Its Comeback.** *Modern Industry*, v. 14, Dec. 15, 1947, p. 46-49.

Numerous new applications of brazing in mass production.

**22-782. Seam Welding Composite Plates.** O. R. Carpenter. *Steel*, v. 121, Dec. 22, 1947, p. 64-66, 83-84.

Method using overlapping spot welds. Equipment, applications, and metallurgical considerations; a new variation of the slabbing process. (Presented at Petroleum Conference of A.S.M.E., Houston, Texas, Oct. 5-8, 1947.)

**22-783. Welding Characteristics of High-Temperature Alloys.** C. G. Chisholm. *Steel*, v. 121, Dec. 29, 1947, p. 54-56, 58, 60.

Most high-temperature materials can be joined by practically all welding methods. Choice of joining process depends upon equipment available and part to be welded, as well as service for which it is intended.

**22-784. Mechanized Scarfing Conditions; 4½ x 5⅞-In. Billets at Average Rate of 125 Ft. Per Min.** *Steel*, v. 121, Dec. 29, 1947, p. 74, 76.

Use of type CM-38 Lin-De-Surfacer scarfing machine to replace 50 hand chippers.

**22-785. Resorts to Battery Power in Mass-Welding Phonograph Turntables.** *Steel*, v. 121, Dec. 29, 1947, p. 76.

**For additional annotations indexed in other sections, see: 12-219; 16-166; 18-273; 19-449; 23-494-499-521-522; 24-393-394-396-428; 27-260.**

## 23 INDUSTRIAL USES and Applications

**23-468. 16-Ton Mineral Wagons: L.M.S. Railway.** *Engineering*, v. 164, Oct. 17, 1947, p. 367-368, 372.

All-steel construction and assembly by British firm.

**23-469. Application Tables to Guide in the Selection of Materials. Part I.** Zola Fox. *Product Engineering*, v. 18, Nov. 1947, p. 165, 167, 169.

Materials and applications listed are those used principally in machine design. Wrought carbon steels, stainless steels, alloy steels, copper and nickel alloys, and aluminum alloys covered.

**23-470. Build Your Truck From Standard Aluminum Parts.** *Food Industries*, v. 19, Nov. 1947, p. 102-104.

Fabrication of individual styles of van-type truck bodies is made possible by use of standard sides and doors of varying lengths, heights, and designs.

**23-471. Tools for Plastics Fabrication.** *British Plastics*, v. 19, Oct. 1947, p. 465-466.

Use of tungsten-carbide-tipped saws and cutters.

**23-472. Elektron Molding Boxes.** *Foundry Trade Journal*, v. 83, Oct. 16, 1947, p. 127-128.

Boxes are made of magnesium alloy; their advantages, design, and manufacture.

**23-473. Minerals for Chemical and Allied Industries. A Review of Sources, Uses and Specifications—Part XIV.** Sydney J. Johnstone. *Industrial Chemist*, v. 23, Oct. 1947, p. 681-687.

Mica, vermiculite, and molybdenum and its compounds. (To be continued.)

**23-474. Stainless Steel Piping; Selection of Pipe Joints.** J. D. Mattimore. *Heating, Piping & Air Conditioning*, v. 19, Nov. 1947, p. 84-87.

Selecting types of joints for maintaining sanitary conditions, avoiding fluid contamination, and reducing the possibilities of crevice-type corrosion.

**23-475. Gasification of Lignite and Subbituminous Coal; Progress Report for 1945-46.** V. F. Parry and others. *Bureau of Mines R. I. 4128*, Sept. 1947, 69 p.

Design, construction, and operation of two pilot plants with externally heated retorts for gasification of low-rank fuels. Emphasizes the behavior of the mild steel retort clad with ⅛-in. sheets of 28% Cr steel.

**23-476. Means of Improving Microstructural Quality of Piston Rings.** N. E. Chernobaeva. *Industrial Power (U.S.S.R.)*, v. 4, Sept. 1947, p. 11-12. (In Russian.)

In the manufacture of cast-iron piston rings, rejections due to unsatisfactory microstructures were materially reduced by increasing the radial thickness of the rings 1.0 to 1.2 mm. so that the unsatisfactory structure was limited to the part of the ring removed during machining.

**23-477. Aluminum for Warm Air Ducts.** *Fueloil & Oil Heat*, v. 6, Nov. 1947, p. 72-74, 136, 139.

Properties and advantages; data for the installer.

**23-478. Les Postes Récepteurs de T. S. F. (Radio Receivers of T. S. F.)** Jacques Piget. *Revue de l'Aluminium*, v. 24, Sept. 1947, p. 265-269.

Use of aluminum parts in radio sets.

**23-479. L'Aluminium au Theatre. (Aluminum in the Theater.)** *Revue de l'Aluminium*, v. 24, Sept. 1947, p. 270-274.

Miscellaneous applications.

**23-480. Urbanisme et Habitation. (Urban Housing Construction.)** Maurice Victor. *Revue de l'Aluminium*, v. 24, Sept. 1947, p. 275-286.

Use of aluminum in construction of houses in France.

**23-481. Magnesium in Germany, 1939-45.** F. A. Fox. *Metal Treatment*, v. 14, Autumn 1947, p. 169-174.

Some of the principal wartime developments in magnesium technology discovered by Allied investigators. Improvements in the electrolytic process; development of new alloys; ordinary casting; pressure die-casting; casting for wrought fabrications; extrusion; rolling; forging; welding; protection; and applications.

**23-482. The Manufacture and Use of Rubber and Plastic Mill Rolls.** K. F. Schmidt. *United Effort*, v. 27, Nov. 1947, p. 3-6.

**23-483. Compressed Air Helps to Make Better Cables.** *Wire and Wire Products*, v. 22, Nov. 1947, p. 896-897.

Use of compressed air to operate various machinery in cable fabrication.

**23-484. Radiant Heat With Copper Tubing. Part II. Fabrication of Heating Coils.** D. L. Mills and L. J. LaTart. *Heating and Ventilating*, v. 44, Nov. 1947, p. 95-98.

Radiant-heating installation in the metallurgical laboratory of Revere Copper and Brass will be used as a source of fabrication, performance, and heat-transfer data, as well as serving the laboratory building as a heating system. Fabrication techniques.

**23-485 Practical Problems of Light Presswork Production. (Continued.)** J. A. Grainger. *Sheet Metal Industries*, v. 24, Nov. 1947, p. 2214-2216.

Trimming, beading, guillotine cutting. (To be continued.)

**23-486. Die Castings That Cost Less Than Screw Machine Products.** Herbert Chase. *Materials & Methods*, v. 26, Nov. 1947, p. 90-94.

While tooling costs for die casting of small parts often run higher than for screw machines, they are frequently offset by large savings in scrap and by decreased cost of secondary operations.

**23-487. Wire Braiding and Precision Wire Braiding.** G. Wightman. *Wire and Wire Products*, v. 22, Nov. 1947, p. 888-890, 926.

Some British machines for fabrication of twisted and braided cables.

**23-488. Broader Application for Standard Hole Punching Units.** *Tool Engineer*, v. 19, Nov. 1947, p. 32.

Extension of application of standard hole punching and notching units, by mounting in press brakes to provide considerably faster setups and easier and less expensive storage of patterns in addition to increased output and reduced downtime.

**23-489. Design of a Gas Heater.** *Die Castings*, v. 5, Nov. 1947, p. 21, 39-42.

Gas heater made from aluminum die castings.

**23-490. The Use of Die Castings in Product Redesign.** *Die Castings*, v. 5, Nov. 1947, p. 22-26, 28, 30-35, 42.

Survey of over 1600 plants in seven general fields of manufacture to determine more specifically the part which die castings are playing in current product redesign.

**23-491. Experiences With Panel Construction.** L. F. Booth. *Engineering*

*(Turn to page 44)*

## 'Metallurgical Philosopher' Analyzes Trends in Steel Industry, Fissile Metals

Reported by Richard T. Saeger
*Foreman, Metallurgical Div.*
*Bethlehem Steel Co.*

As a metallurgical philosopher (a man with detached, open-minded view) Ernest E. Thum, editor of *Metal Progress*, analyzed some trends in the steel industry and pictured a future steel plant that John Fritz would never recognize. Mr. Thum addressed a joint meeting of the A.S.M.E. and the Lehigh Valley Chapter in Allentown, Pa., in December. The title of his talk was "Metallurgy as a Philosopher Might Look at It".

In research he cited the Taylor-White experimentation on high speed steel to warn against limitations imposed by prior art or preconceptions. In reminding his audience of the variability of technical processes and results, he spoke of statistical analysis, the mathematics of probability, and a fanciful allusion to the "law of averages".

This brought the speaker to his second viewpoint—that of a philosopher who is seeking for the broadest truths—wherein he pointed out that the work since 1900 on radioactive and fissile metals has wrecked many of the *a priori* principles of prior systems of thought and human actions. An entirely new system of philosophy is in the making.

He argued against the feeling that seems to be more and more widely held, and stoutly contended that common citizens can readily understand enough of the scientific and engineering developments of the day so that their collective judgment as to the control and *use* of such things as nuclear energy is still the ultimate and only safe tribunal.

## Boynton Heads Temple Metallurgical Department

After 40 years as metallurgist for the John A. Roebling's Sons Co., Henry C. Boynton has been appointed head of the new metallurgical department at Temple University.

Dr. Boynton is a graduate of Harvard University, where he received his Ph.D. in 1904. While at Harvard he worked under the late Albert Sauveur, who, no doubt, had considerable influence in changing Dr. Boynton's interest from geology to metallurgy.

Dr. Boynton is a charter member and past chairman of the Philadelphia Chapter, and is a member of a number of other engineering societies. In addition to his duties in the metallurgical department, Dr. Boynton is actively engaged as a consultant in the Temple University Institute of Research.

## Survey of Resources Covers Missouri Basin

Reported by C. G. Atchinson
*Assistant Chief Metallurgist*
*Sheffield Steel Corp.*

The economic importance of the mineral resources of the Middle West was ably presented by George W. Ward, chairman of the inorganic chemistry division of Midwest Research Institute, at the November meeting of the Kansas City Chapter.

Midwest Research Institute has recently compiled "A Survey and Scientific Analysis of Potentialities of Major Natural Resources in the Missouri River Basin" for the Army Engineers. This work covers the resources of the area between the Rocky Mountains and the Mississippi River from Canada to Mexico.

The greatest wealth of this area lies in nonmetallics, headed by known reserves of 2 trillion tons of coal widely distributed over the area. Bentonite, gypsum, dolomite and limestone are widely distributed. Wyoming and Montana have large deposits of phosphate rock, and large deposits of salt are being worked at Hutchinson, Kan. Missouri produces $25 million per year of clay products, mainly refractories.

The metallic wealth of the area consists mainly of gold in the Black Hills district, zinc and lead in the tri-state district and iron ore in East Texas.


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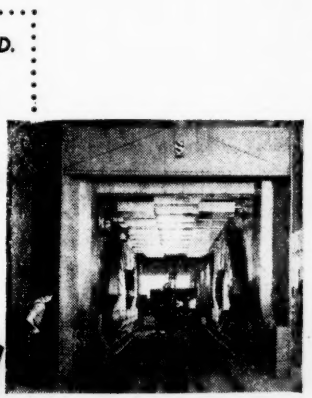

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*News-Record*, v. 139, **Nov. 13, 1947**, p. 136-139.

Use of large metal panels for floors and walls in large buildings. Floors are composed of cellular steel plank and exterior walls of insulated, steel-and-aluminum panels. Interior partitions of asbestos-cement slabs clipped to steel studs are used in the laboratory.

**23-492. Continental Rearranges Production Facilities for Smoother Operation.** Joseph Geschelin. *Automotive Industries*, v. 97, Nov. 15, 1947, p. 34-35, 74.

Equipment and procedures.

**23-493. What Size Is Hot Work?** L. W. Macomber and C. N. Weiler. *American Machinist*, v. 91, Nov. 20, 1947, p. 101-104.

Effects of variations in room and operating temperatures on ... problem of making close fits with aluminum and magnesium. Procedures for compensating for these variations.

**23-494. Automatic Welding of Vital Parts for Coal Loader.** C. W. Lytton. *Mechanization*, v. 11, Oct. 1947, p. 91.

Use of automatic arc welding to double daily production of parts with positive alignment of various members, and to cut labor cost.

**23-495. Gravity and Pressure Die Castings Used in the Minilift Portable Hoist.** H. K. and L. C. Barton. *Machinery (London)*, v. 71, Oct. 30, 1947, p. 495-498.

**23-496. High-Temperature Alloys; Development for Gas Turbines.** William T. Griffiths. *Metal Industry*, v. 71, Oct. 31, 1947, p. 359-362; Nov. 7, 1947, p. 379-381; Nov. 14, 1947, p. 401-403.

Condensed from Paper presented to Royal Aeronautical Society, Oct. 23, 1947.

**23-497. A New Plant and a New Product.** *Western Machinery and Steel World*, v. 38, Nov. 1947, p. 98-101.

Design and production of heavy-duty brake mechanism called "the mountain brake" for use on trucks, buses, and heavy trailers.

**23-498. All-Welded Sandwich Shops.** *Sheet Metal Worker*, v. 38, Nov. 1947, p. 62-63.

Prefabricated sandwich shops, of all-welded stainless steel and aluminum construction.

**23-499. Building, Repairing and Design of Farm Machinery.** Ernest J. Koop. *Welding Journal*, v. 26, Nov. 1947, p. 988-990.

Presented at 28th Annual Meeting, American Welding Society, Chicago, week of Oct. 19, 1947.

**23-500. Hard Materials for Rock Bits. Part I.** R. W. Adamson. *Mining Congress Journal*, v. 33, Nov. 1947, p. 38-41.

History of tungsten carbide bits; their characteristics and the research that led to their development. (To be continued.)

**23-501. Photo-Engraving Being Done on Magnesium.** H. E. Swayze. *Photo-Engravers Bulletin*, v. 37, Nov. 1947, p. 154-162.

The Perry-Higgins process and its utilization by a weekly newspaper. General procedures and advantages.

**23-502. Cannon Electric Boosts Southland's Die Casting Output.** Leslie Baird. *Western Metals*, v. 5, Nov. 1947, p. 22-23.

Procedures and equipment for manufacture of die-cast electrical parts.

**23-503. Aircraft Air Compressors.** J. A. Oates. *Aircraft Production*, v. 9, Nov. 1947, p. 425-429.

Production and inspection operations employed by Hymatic Engineering Co., Ltd.

**23-504. Northwest Tube and Metal Fabricators Good Illustration of Diversified New Industry in Portland, Oregon.** Gerald E. Stedman. *Modern Industrial "Press"*, v. 9, Nov. 1947, p. 29, 32, 34.

Procedures and equipment, mainly in welding, pressing, and shearing.

**23-505. Aluminum Trolley Coaches.** *Modern Metals*, v. 3, Nov. 1947, p. 14-15.

**23-506. Aluminum for Bars.** *Modern Metals*, v. 3, Nov. 1947, p. 24-26. (Translated from *Revue de l'Aluminium*.)

French practice in use of aluminum for bars and counters.

**23-507. Railway Bogies.** *Iron and Steel*, v. 20, Nov. 1947, p. 521-523.

Replacement of assemblies by steel castings.

**23-508. Drier Rolls; Characteristics of the Jacketed Steel Type.** George L. Snyder. *Iron and Steel*, v. 20, Nov. 1947, p. 528-530.

Condensed version of a paper recently presented to the American Pulp and Paper Mill Superintendents' Assoc.

**23-509. "Standing-Up to It".** *Light Metals*, v. 10, Nov. 1947, p. 551.

After 11 months' use, aluminum alloy bars did not sag or warp when used as supports for cooking utensils above the flames of a gas stove.

**23-510. Light Alloys in the Internal-Combustion Engine. (Continued.)** *Light Metals*, v. 10, Nov. 1947, p. 552-560.

Light-alloy pistons. (To be cont.)

**23-511. Behind the Door.** *Light Metals*, v. 10, Nov. 1947, p. 573-575.

Some of the aluminum castings and extruded sections used for the world's largest door (for the hangar for the British Brabazon I).

**23-512. In the Service of Science. (Concluded.)** *Light Metals*, v. 10, Nov. 1947, p. 576-580.

Some further applications of aluminum to laboratory apparatus; the possibilities of magnesium. 10 ref.

**23-513. Prefabricated Light Metal Coachwork in France.** Graham Davies. *Light Metals*, v. 10, Nov. 1947, p. 586-601.

Production of light-metal coach bodies in progress in France. Detail drawings.

**23-514. Commutators With Anodized Aluminum Insulation.** H. Blaess. *Light Metals*, v. 10, Nov. 1947, p. 602-603. (Translated from *Die Technik*, v. 2, 1947, p. 247).

By a suitable modification of the commutator assembly process, mica may successfully be replaced by an alumina film.

**23-515. Some Recent Applications of Cemented Carbide.** K. R. Beardslee. *Machinery (London)*, v. 71, Nov. 6, 1947, p. 507-512.

**23-516. Aluminum Coated Steel Strip.** *Machinery (London)*, v. 71, Nov. 6, 1947, p. 512.

Production in Germany for use as electric cable tape, and for telephone diaphragms, flexible metallic tubing, and a variety of similar applications. (From B.I.O.S. Report No. 1467.)

**23-517. Iron and Steel and Refrigeration. No. II.** Dudley Gordon. *Engineer*, v. 184, Nov. 7, 1947, p. 430-431.

22 references.

**23-518. Construction of All-Steel Wagons on the L.N.E.R.** *Engineer*, v. 184, Nov. 7, 1947, p. 436-437.

**23-519. Versatility of High-Strength Steels.** *Steel*, v. 121, Nov. 17, 1947, p. 104.

Weight-saving possibilities through proper design and utilization. Miscellaneous applications. (Based on paper by H. Malcolm Priest before Pittsburgh section of A.S.T.M.)

**23-520. Rapid Stud Driving Fixture.** Herbert Chase. *Iron Age*, v. 160, Nov. 27, 1947, p. 74-75.

Special fixture automatically locates the radio grille of an automobile under a hopper-fed stud driver and permits the setting of up to 6000 studs a day by one operator.

**23-521. Welding Facilitates Assembly of Silicone Engine Dampers.** Joseph Geschelin. *Automotive Industries*, v. 97, Dec. 1, 1947, p. 24-25.

In a torsional-vibration damper developed by Houdaille-Hershey, a small volume of a high-viscosity silicone fluid fills the clearance between flywheel and housing. Various steps in the assembly of these devices, including the submerged-arc welding of the outer and inner edges of the cover to the housing.

**23-522. A Welded Stainless Steel Worm.** *Welder*, v. 16, July-Sept. 1947, p. 67-68.

Machine used in automatic molding and wrapping of butter and margarine. One of the essential features is the stainless-steel feed screw or worm.

**23-523. Pre-Cutting of Aluminum Houses.** W. J. Granberg. *Light Metal Age*, v. 5, Nov. 1947, p. 14-16.

Procedures and equipment for cutting and forming of parts for prefabricated houses.

**23-524. Aluminum Industry in Australia.** Charles Lynch. *Light Metal Age*, v. 5, Nov. 1947, p. 18-19.

Fabrication procedures.

**23-525. Processing and Fabrication of Stainless Steel Sheet and Plate Products. Part VIII. (Continued.)** H. S. Schaufus and W. H. Braun. *Steel Processing*, v. 33, Nov. 1947, p. 681-684, 704.

Applications in various fields of industry and commerce, including architecture, food, dairy, beverage, chemical, textile, and high-temperature industries. (To be concluded.)

**23-526. Bimetallic Plates. Part V.** J. S. Mertle. *National Lithographer*, v. 54, Nov. 1947, p. 38-39.

Considers the work of A. R. Trist and William C. Huebner. (To be continued.)

**23-527. The Tri-Metal Plate: Does It Meet a Great Need of the Lithographic Industry?** Paul Whyzmuzis. *National Lithographer*, v. 54, Nov. 1947, p. 40-41, 103-105.

The base metal (steel or zinc or an alloy of these metals) is first plated with copper, then with chromium. Advantages of this plate; results of test runs which show great durability; method of processing.

**23-528. Rayon Motor: Operation in an Acid Atmosphere.** C. L. Hamm and J. S. Boudreau. *Die Castings*, v. 5, Dec. 1947, p. 21, 45-46.

Application of aluminum die castings.

**23-529. Die Castings in the Construction of Electric Locomotives.** P. W. Thompson, C. E. Mathews, and W. J. Simpson. *Die Castings*, v. 5, Dec. 1947, p. 22-24, 39.

Use of about 400 zinc, aluminum, and copper die castings in heavy-duty transportation equipment.

**23-530. Tin Die Castings in Testing Equipment.** C. N. Svenson. *Die Castings*, v. 5, Dec. 1947, p. 31-32, 49.

Use of a special tin alloy developed for die casting instrument parts to give exceptional dimensional stability. This method has been chosen as the most practical method of assembling pole pieces. Composition of the alloy is not given, other than stating that it contains tin, copper, lead, and zinc.

**23-531. Network Protector for Power Systems.** J. T. Clenny and L. H. Sperow. *Die Castings*, v. 5, Dec. 1947, p. 36-38.

Solution of difficult fabricating problems by die casting four major parts of the G.E. network protector. Other zinc and lead-base die castings go into circuit breakers and fuses.

**23-532. Unusual Tooling Expedites Midget Electric Motor Output.** F. R. Schulz. *Iron Age*, v. 160, Dec. 4, 1947, p. 64-67, 140.

Use of die castings and unusual techniques for production of miniature electric motors of 0.0005 hp. weighing about 3 oz. and operating on 1½ volts. The methods require that precision be combined with ingenious methods for handling the very small parts involved. Machining operations and an unusual setup for winding the extremely small coils on the armature.

**23-533. Producing Bumpers at Auto-Lite.** *Iron Age*, v. 160, Dec. 4, 1947, p. 84-85.

Procedures and equipment for press-

*(Turn to page 46)*

## Inspection Trips Made To Westinghouse Plant And Cornell Laboratories

Reported by George F. Kappelt
*Assistant Metallurgist*
*Bell Aircraft Corp.*

Plant visits to the Westinghouse Electric Corp. and the Cornell Aeronautical Laboratories were made in November by nearly 100 members of the Buffalo Chapter ⚙. After being first entertained at dinner by Westinghouse, the guests made a trip through the complete Buffalo plant to inspect the manufacture of a.c. and d.c. motors, electric welders, and copper wire.

Extensive use of automatic welders is made in the manufacture of the Westinghouse Lifeline motor. The frames of the motor are made entirely from fabricated steel parts. The percentage of rejection for defective welding is negligible.

Copper wire drawing, enameling, and covering were also inspected. The Buffalo Division of Westinghouse is being equipped to produce all the wire used by the company—about four carloads per day.

The trip then proceeded through the Cornell Aeronautical Laboratories (formerly the Curtiss-Wright Research Laboratories). Although many of the projects on which the laboratories are working are on the restricted list, the full physical facilities were shown to the group.

Laboratories are fully equipped for structures, aerodynamics, metallurgy, welding, plastics, chemistry and spectrography, and hydraulics. A model shop and a wind tunnel are also included. The importance and quality of the work carried out by the laboratories can be judged to some extent by the recent praise given to them by both the Army and the Navy.

## X-Rays Gage Thickness Of Sheet During Rolling

Reported by Henry Hauseman
*Metallurgist, LaPlant-Choate Mfg. Co.*

X-ray therapy and other important uses found wide acceptance by the medical profession long before industry realized its possibilities, and created a demand for suitable equipment, E. Dale Trout told the December meeting of the Cedar Rapids Chapter ⚙. The speaker, who is director of the phototechnical section, General Electric X-Ray Corp., Milwaukee, lectured on "The Uses of X-Ray in Industry". Two of the earliest uses of industrial X-ray were for the inspection of rubber heels, and the inspection of citrus fruit damaged by unseasonable weather.

Two methods of using X-ray are fluoroscopy, which gives no permanent record and is dependent upon the skill of the operator for satisfactory results, and radiography, where a permanent record is made on X-ray film. Mr. Trout stated that penetrating power of the X-ray is a function of the voltage. Equipment using 10 million volts is now being regularly produced while equipment employing 100 million volts has been produced for special applications.

Mr. Trout closed his talk with a description of a very unusual and novel use of the X-ray. In the continuous rolling of the smaller gages of sheet steel, the penetrating properties of the X-ray are used to measure the thickness of the steel before it reaches the last stand of rolls. Automatic adjustment in the distance between the rolls of the final stand is continuously made so that the steel will be rolled to absolute thickness.

### Fatigue Symposium Delayed

Quite a number of American metallurgists who have ordered copies of the "Symposium on the Failure of Metals by Fatigue" held a good many months ago at the University of Melbourne in Australia will be interested to know that printing and publishing difficulties are as prevalent in that country as in this. Publication of the book has encountered continued delays, but delivery is now expected about March of this year.


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ing, plating, polishing, buffing, and inspection.

**23-534. Volume Fabricating Methods Increase Motor Coach Output.** C. H. Hopper. *Production Engineering & Management*, v. 20, Dec. 1947, p. 51-55.

Procedures, layout, and equipment using sheet steel, structural steel, sheet aluminum, and aluminum extrusions.

**23-535. Specialized Processes Effect Economies in Parts Processing.** *Production Engineering & Management*, v. 20, Dec. 1947, p. 62-70.

Procedures and equipment for manufacturing Underwood typewriter.

**23-536. A Description of an Australian Can-Making Plant.** *Sheet Metal Industries*, v. 24, Dec. 1947, p. 2419-2424.

Methods at the Queensland Can Manufacturing Co., Ltd., including finishing procedures.

**23-537. A Visit to the New Factory of Fisher and Ludlow, Ltd., by the Institute of Vitreous Enamellers.** John Hooper. *Sheet Metal Industries*, v. 24, Dec. 1947, p. 2447-2450.

Miscellaneous fabrication procedures, which include manufacture of Bendix washing machines.

**23-538. Engineering Economics of Magnesium.** Harold A. Knight. *Materials & Methods*, v. 26, Dec. 1947, p. 61-65.

General cost advantages; prices; magnesium vs. other metals; magnesium in aircraft; light weight as a cost factor in trucks; other economical applications; future prospects.

**23-539. Steel Tubing and Plate Replace Castings in Heavy-Duty Parts.** Kenneth Rose. *Materials & Methods*, v. 26, Dec. 1947, p. 68-70.

How forming and welding are combined to produce light-weight, defect-free parts for tough railroad service.

**23-540. When and How to Use Cast Iron.** T. E. Eagan. *Materials & Methods*, v. 26, Dec. 1947, p. 71-75.

Characteristics of present-day gray iron which make it an engineering material which is selected for its ability to do a job rather than only because of cheapness, as was once the case. (Presented before joint meeting of the A.S.T.E. and A.F.A.)

**23-541. Making the "Christmas Tree" Express.** Charles H. Wick. *Machinery*, v. 54, Dec. 1947, p. 147, 154.

Production of pressed and die-cast metal and plastic toy trains on a mass production basis by Lionel Corp.

**23-542. Modern Machines Speed Production at Richmond Pump Plant.** Ralph G. Paul. *Western Machinery and Steel World*, v. 38, Dec. 1947, p. 68-71, 101-103.

Operating principles of the injector-type "jet-pump" and how it is produced.

**23-543. Magnesium Armor.** Paul R. Burt. *Western Machinery and Steel World*, v. 38, Dec. 1947, p. 72-75, 104.

Production of suit of armor for actor in film which enacts a story of the 15th century.

**23-544. Hand Tools for the World Market.** *Western Machinery and Steel World*, v. 38, Dec. 1947, p. 76-79, 100.

Production of wrenches, pliers, screw drivers, hammers by Plomb Tool Co.

**23-545. A Western-Built Press Brake.** George W. Freiberger. *Western Machinery and Steel World*, v. 38, Dec. 1947, p. 83-85.

Production of hydraulic press brakes by Pacific Industrial Mfg. Co., Oakland, Calif.

**23-546. Compressed Air in Spring and Bumper Production.** *Western Machinery and Steel World*, v. 38, Dec. 1947, p. 86-88, 111.

Forming, cleaning, and plating operations at United States Spring and Bumper Co., Los Angeles.

**23-547. Engineered Steel Plate Work.** *Western Machinery and Steel World*, v. 38, Dec. 1947, p. 89-93.

Fabrication of miscellaneous items by Pacific Coast Engineering Co., Alameda, Calif.

**23-548. Report on Vacuum Tools.** Thomas A. Dickinson. *Tool Engineer*, v. 19, Dec. 1947, p. 41-43.

Principles of vacuum techniques and their application to tool engineering.

**23-549. Aluminum Replaces Steel in Ford Parts.** Chester S. Ricker. *American Machinist*, v. 91, Dec. 4, 1947, p. 96.

Substitution saves 120 lb. of raw material on each car and frees enough to build 100,000 additional cars.

**23-550. British Jet Engines in Production.** *Automotive Industries*, v. 97, Dec. 15, 1947, p. 36-37.

**23-551. Engineering Uses for Steel Castings.** John A. Bassenfoss. *Steel*, v. 121, Dec. 15, 1947, p. 90-91, 102, 104, 106.

Instances in which steel castings are used to advantage from an engineering and economic viewpoint. Most reliable basis for accepting a casting is a simulated service test on the casting as a unit, rather than properties of test bars.

**23-552. Latest Metalworking Equipment Employed at New Chevrolet Indianapolis Truck Plant.** *Steel*, v. 121, Dec. 22, 1947, p. 62-63, 88.

**23-553. Selecting Aluminum Alloys for Specific Applications.** Herbert Dobkin. *Steel*, v. 121, Dec. 22, 1947, p. 67-70.

**23-554. Selecting Alloy Structural Steels for High-Toughness Applications.** Bernard S. Lement. *Iron Age*, v. 160, Dec. 25, 1947, p. 80-84.

A simplified procedure consists of the following steps: Determine yield strength needed; select quenching medium; decide on the degree of martensitization to be imparted; and select the proper alloy steel from the table presented. The method is limited to yield strengths in the range of 80,000 to 150,000 psi. and to section sizes up to 5 in. in diameter. 10 ref.

**For additional annotations indexed in other sections, see: 3**-383; **19**-434; **20**-687; **22**-739-741; **27**-257-280.

## 24 DESIGN

**24-378. Small Zinc Alloy Die Castings—Economic and Design Advantages.** Joseph Saks. *Product Engineering*, v. 18, Nov. 1947, p. 86-89.

Engineering design data. Tables compare relative advantages of various production methods.

**24-379. Flame-Cut Disk Flywheels.** *Product Engineering*, v. 18, Nov. 1947, p. 141-143.

Strength, kinetic energy, weight, and cost are compared with those of wheels with cast spokes.

**24-380. Stamping Design and Fabrication for Porcelain Enameling.** Carl F. Benner. *Tool & Die Journal*, v. 13, Nov. 1947, p. 70-73.

Recommended procedures and designs.

**24-381. Preignition Piston Failure Diagnosed in Single-Cyl Tests. Excerpt from "Piston Failure by Preignition and Detonation"**, by A. G. Cattaneo and E. P. Viscia. *SAE Journal*, v. 55, Nov. 1947, p. 54-60.

Local peak piston temperatures govern whether and where piston failure takes place. This temperature is determined by general temperature level and temperature distribution on the piston and by the effects of local blowby and scuffing. Effects of other factors. (Presented at S.A.E. Northern California Section, San Francisco, Dec. 10, 1946.)

**24-382. The Design of Stops for Press Tools.** E. Barron. *Machinery (London)*, v. 71, Oct. 16, 1947, p. 432-435.

**24-383. Specifying for Economy in Springs. Part I.** Ronald F. Pond. *Machine Design*, v. 19, Nov. 1947, p. 120-122.

Tells how to draw up specifications for springs which will do the job satisfactorily and yet not be more expensive than necessary.

**24-384. Stability of Plates and Shells Beyond the Proportional Limit.** A. A. Ilyushin. *National Advisory Committee for Aeronautics Technical Memorandum No. 1116*, Oct. 1947, 46 p.

A mathematical development. Results are applied to a typical problem. (Translated from *Applied Mathematics and Mechanics (U.S.S.R.)*, N.S. 8, no. 5, 1944, p. 337-360.)

**24-385. Strength Variations Under Alternating Stress With Phase Differences.** G. V. Uzhik. *Bulletin of the Academy of Sciences of the U.S.S.R., Section of Technical Sciences*, June 1947, p. 709-716. (In Russian.)

A theoretical development of the changes in strength which occur in plane-stressed material under the influence of out-of-phase alternating stresses of the same frequency.

**24-386. Drill Jig Accuracy Without Costly Construction.** Robert Mawson. *Production Engineering & Management*, v. 20, Nov. 1947, p. 64.

How manufacturing cost of drill jigs can be lowered by confining accuracy to essential parts and eliminating unnecessary finish.

**24-387. Stress-Strain and Elongation Graphs for Alclad Aluminum Alloy 75S-T Sheet.** James A. Miller. *National Advisory Committee for Aeronautics Technical Note No. 1385*, Nov. 1947, 38 p.

Stress-strain, stress-deviation, tangent-modulus, and reduced-modulus graphs are plotted on a dimensionless basis to make them applicable to material with yield strengths which differ from those of the test specimens.

**24-388. A Method of Calculating the Compressive Strength of X-Stiffened Panels That Develop Local Instability.** George L. Gallaher and Rolla B. Boughan. *National Advisory Committee for Aeronautics Technical Note No. 1482*, Nov. 1947, 17 p.

Method can be used to calculate the critical compressive stress above, as well as within, the elastic range. For stresses above 15% of the compressive yield stress, the method can be used for approximate determination of average compressive stress at maximum load.

**24-389. Flange Design Calculations.** Harald E. Lonngren. *Petroleum Refiner*, v. 26, Nov. 1947, p. 130-134.

New formulas for determining flange thickness quickly with an assurance of obtaining a predetermined and uniform stress distribution in the flange.

**24-390. Internal Stresses in Metals and Alloys.** *Engineer*, v. 184, Oct. 24, 1947, p. 393-394.

Summarizes five papers and accompanying discussion presented on the subject of "Measurement of Internal Stresses" at Symposium held by the Institution of Mechanical Engineers, Oct. 15-16, 1947.

**24-391. Economy in Small Parts.** *Die Castings*, v. 5, Nov. 1947, p. 36-42.

Design changes in four small parts easily held in the palm of the hand which are claimed to result in over $100,000 savings in production. These are: center winding contact sector for self-winding clock; flash-gun component; and combination lock case and cover. Die castings play a large part in the new designs.

*(Turn to page 48)*

# Avery Untangles Complexities of Cast Heat Resistant Alloys

Reported by Frank P. Kristufek
*U. S. Steel Corp. Research Laboratories*

The complexities of cast heat resistant alloys were untangled for the members of the New Jersey Chapter at the meeting on Nov. 17. The speaker, Howard S. Avery, research metallurgist of the American Brake Shoe Co., approached his subject from the viewpoint of the different fields of service of these alloys.

Mr. Avery explained the basic metallography that generally controls the behavior of the several hundred available heat resistant alloys, and touched on the turbo-alloys developed in recent years. Most of his talk, however, was confined to about a dozen of the older types that are widely used in furnaces, refineries, and steam turbines, and which account for nearly 98% of present alloy casting production.

The factors most important in the selection and application of heat resisting alloys are load-carrying ability or creep strength; resistance to sulphur-bearing gases, to oxidation and to thermal expansion; ductility; resistance to carburization in high-carbon atmospheres; and, for certain alloys, austenite stability. Since the amount of ferrite present has a great influence on the limiting creep stress of the material, certain alloys that are near the austenite-ferrite boundary in the ternary nickel-chromium-iron composition diagram require balancing of their compositions with carbon or other minor elements to assure the austenitic condition.

Mr. Avery explained how chromium is used primarily for oxidation resistance, while increasing the nickel content increases limiting creep stress, austenite stability and resistance to carburization but decreases sulphur resistance and hardenability. Nickel also produces a desirable decrease in thermal expansion.

The very popular 26% chromium, 12% nickel alloy is typical of the materials that require composition balancing to maintain the austenite condition. It is a good all-round material except for carburizing service. The popular 35% nickel, 15% chromium alloy, which is quite stable and presents no balancing problem, has an excellent combination of strength, ductility, resistance to carburization and oxidation resistance. It is the strongest of all the commonly used materials at 1400° F. These two alloys share about 75% of the total production equally between them.

A very promising alloy on which engineering data have until now been lacking but, which should increase in importance in the future is the 26% chromium, 20% nickel alloy. It has good austenite stability, good carburizing resistance when fortified with silicon, and good retention of hot ductility after service in carburizing gases.

One of the chief points developed in a long and lively discussion period was that no alloy is able to provide the maximum properties in every respect at a reasonable cost. With the 26% Cr, 12% Ni alloy, for example, it is impossible to get the best combination of high limiting creep or rupture strength and ductility unless the foundry is given complete leeway to "balance" the composition. Users should specify the properties they want in a given type of alloy and permit the foundry to balance the composition to achieve those properties.

An exceptionally good motion picture "Tornado in a Box", explaining the development and operation of the gas turbine, was shown through the courtesy of Allis-Chalmers Mfg. Co. The technical chairman for the meeting was Joseph B. Shelby, manager of the foundry department at Driver-Harris Co.

## Knu-Vise and Lapeer Merge

Knu-Vise, Inc., and Lapeer Mfg. Co. have merged organizations, the new company being known as Lapeer Mfg. Co. While the plant is in Lapeer, Mich., general sales offices and the engineering department are in Detroit. The new firm will continue to manufacture Knu-Vise toggle-action clamps and pliers.

# Martempering Furnace Automatically Removes Contaminating Salts

Reported by L. R. Maitland
*Talon, Inc.*

The application of salt bath furnaces to the heat treating of metals was discussed by A. F. Holden, president of the A. F. Holden Co., in a dinner meeting held by the Northwestern Pennsylvania Chapter.

Mr. Holden listed the different types of salt bath furnaces in use today, and then described his latest design of a martempering furnace which automatically removes the contaminating high-temperature salts that have been carried over by the work. This is done by a series of screens in the cooling trough through which a pump keeps a continual stream of flowing salt.

Certain designs of tools which can be heat treated in a salt bath with less distortion and chance of cracking than in any other method of heat treating were illustrated. Photomicrographs of the cross sections of these tools showed the uniformity and grain structure.

Automatic equipment is also used for copper and brass brazing. The work is assembled and placed in racks which, in turn, are placed on a continuous salt bath conveyer. These racks are then immersed in the different salt baths for the correct length of time, thus guaranteeing a uniform product.

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**24-392. S.A.E. Involute Splines and Applied Involutometry.** Merton W. Seavey. *Tool Engineer*, v. 19, Nov. 1947, p. 43-48.

Diagrams and symbols together with descriptions of the functions of spline and gear-tooth parts. The application of radians to S.A.E. formulas for splines; a glossary of works related to splines.

**24-393. Welding for Economy, Flexibility, Appearance. No. 3. Tractor Yarder.** H. A. Sanner. *Industry and Welding*, v. 20, Nov. 1947, p. 34-36, 38, 78-79.

Problems and solutions in redesigning a piece of heavy equipment which was formerly cast steel. Size, weight, complexity, and cost were materially reduced.

**24-394. Designing for Resistance Welding.** Ernie Lauter. *Industry and Welding*, v. 20, Nov. 1947, p. 55.

Begins series with a few elementary definitions and explanations. (To be continued.)

**24-395. Materials and Their Requirements for Automobile Stampings, Bumpers and Pistons.** Nelson G. Meagley. *Materials & Methods*, v. 26, Nov. 1947, p. 74-78.

Examples of how automotive engineers use service requirements of parts as a means of selecting materials and methods of fabrication.

**24-396. Arc Welded Propeller Hub Weighs and Costs Less.** *Automotive Industries*, v. 97, Nov. 15, 1947, p. 42.

Design of propeller hub which effected a considerable savings in weight and cost over the previous forged structure. This design won first prize, from the James F. Lincoln Foundation's Design-for-Progress contest.

**24-397. The Tuned and Damped Gyrostatic Vibration Absorber.** R. N. Arnold. *Institution of Mechanical Engineers Proceedings*, v. 157, War Emergency Issue No. 25, 1947, p. 1-15; discussion, p. 16-19.

Experimental investigations with a gyrostatic absorber applied to a one-mass system under forced vibration. Design of a full-scale absorber built to suppress vibration of the table of a heavy planing machine.

**24-398. Torsional Stress Analysis of Twist-Drill Sections by Membrane Analogy.** E. T. P. Neubauer and O. W. Boston. *Transactions of the A.S.M.E.*, v. 69, Nov. 1947, p. 897-902.

Experiments to find the nature of the stress distribution in different drill cross sections due to applied torque. Procedure and results.

**24-399. Designing for Industry.** Henry Dreyfuss. *Western Machinery and Steel World*, v. 38, Nov. 1947, p. 78-81, 104.

Some functional design principles.

**24-400. Die-Grams.** Karl L. Bues. *Western Machinery and Steel World*, v. 38, Nov. 1947, p. 102-104.

Design of a progressive pierce-and-blank die. (To be continued.)

**24-401. Recurrence Formulas and Differential Equations for Stress Analysis of Cambered Box Beams.** Joseph Kempner. *National Advisory Committee for Aeronautics Technical Note No. 1466*, Oct. 1947, 52 p.

**24-402. Pipe Columns for Crane Runway Support Increases Rigidity.** Charles G. Herbruck. *Welding Journal*, v. 26, Nov. 1947, p. 993.

Structural design.

**24-403. Fatigue Tests of Welding Elbows and Comparable Double-Mitre Bends.** A. R. C. Markl. *Transactions of the A.S.M.E.*, v. 69, Nov. 1947, p. 869-876; discussion, p. 877-879.

Investigation shows that welding elbows will withstand $2^1/_2$ times as many stress reversals in bending in the plane, and 14 times as many cycles in bending transverse to the plane of curvature, as compared with mitre bends. Internal pressure, stress-relieving and grinding the welds produces no significant change in the endurance strength.

**24-404. Acme Thread Calculations.** J. S. Rojahn. *American Machinist*, v. 91, Dec. 4, 1947, p. 139.

Correlates information from several publications.

**24-405. Critical Compressive Stress for Outstanding Flanges.** Eugene E. Lundquist and Elbridge Z. Stowell. *Twenty-Eighth Annual Report of the National Advisory Committee for Aeronautics 1942 (Technical Report No. 734)*, 1946, p. 111-116.

A chart is presented for the values of the coefficient in the formula for the critical compressive stress at which buckling may be expected to occur in flat rectangular plates supported along the loaded edges, supported and elastically restrained along one unloaded edge, and free along the other unloaded edge. Mathematical derivations of the formulas required. 11 ref.

**24-406. Restraint Provided a Flat Rectangular Plate by a Sturdy Stiffener Along an Edge of the Plate.** Eugene E. Lundquist and Elbridge Z. Stowell. *Twenty-Eighth Annual Report of the National Advisory Committee for Aeronautics 1942 (Technical Report No. 735)*, 1946, p. 111-116.

A sturdy stiffener is defined as a stiffener of such proportions that it does not suffer cross-sectional distortion when moments are applied to some part of the cross section. A formula is given for the restraint coefficient supplied to the plate by such a stiffener. This coefficient is required for calculation of critical compressive stress of the plate. 11 ref.

**24-407. Shear Lag in Box Beams; Methods of Analysis and Experimental Investigations.** Paul Kuhn and Patrick T. Chiarito. *Twenty-Eighth Annual Report of the National Advisory Committee for Aeronautics 1942 (Technical Report No. 739)*, 1946, p. 171-208.

Methods of shear-lag analysis suitable for practical use. Strain-gage tests made by the N.A.C.A. to verify the theory. Numerical examples illustrating the methods of analysis.

**24-408. Square Plate With Clamped Edges Under Normal Pressure Producing Large Deflections.** Samuel Levy. *Twenty-Eighth Annual Report of the National Advisory Committee for Aeronautics 1942 (Technical Report No. 740)*, 1946, p. 209-222.

A theoretical analysis. Values of bending stress and membrane stress at the center of plate and at the midpoint of the edge are given for center deflections up to 1.9 times the plate thickness. The shape of the deflected surface is given for low pressures and for the highest pressure considered. Results compare favorably with exact solutions for long rectangular and circular plates.

**24-409. Normal-Pressure Tests of Rectangular Plates.** Walter Ramberg, Albert E. McPherson, and Samuel Levy. *Twenty-Eighth Annual Report of the National Advisory Committee for Aeronautics 1942 (Technical Report No. 748)*, 1946, p. 269-299.

Tests were made on 56 rectangular plates with clamped edges and five plates with freely supported edges. Center deflection and permanent set were measured. For some of the plates, strains and contours were also measured. Washboarding pressures were determined for three cases. Results are compared with those obtained by theoretical calculations. 13 ref.

**24-410. The Future Development of Machine Tool Design.** J. H. Wilkinson. *Machinery Lloyd (Overseas Edition)*, v. 19, Nov. 8, 1947, p. 88-91.

Presented to Wolverhampton Section of Institution of Production Engineers.

**24-411. Effect of Rib Proportions on Beam Bending Strength.** A. R. Holowenko. *Product Engineering*, v. 18, Dec. 1947, p. 122-123.

How rib proportions influence bending strength. Curves are developed for proportions of ribbed-beam sections that have the same extreme fiber stress as the beam without a rib.

**24-412. Strength and Clamping Force of Bolts.** Kenneth H. Lenzen. *Product Engineering*, v. 18, Dec. 1947, p. 130-133.

Determination of forces in low-carbon steel, stress-relieved and tested under tension and torsion, and torqued by a nut. Derivation of a formula for the torque to be applied to a nut to obtain a desired clamping force. Accuracy of torque-predicted stresses.

**24-413. "Bear-Up" Requirements for Aircraft.** Bo Lundberg. *Aero Digest*, v. 55, Dec. 1947, p. 56-58, 120-122.

Fundamental principles of fatigue strength requirements. (Condensed version of paper, presented at the Second I.C.A.O. Airworthiness Session, Montreal, March 1947.)

**24-414. Salient Features of Handwheel Design.** H. F. Williams. *Machine and Tool Blue Book*, v. 43, Dec. 1947, p. 178-184, 186, 188-191.

Factors influencing the design of handwheels, rim designs, and positive-grip handwheel rims for use on machine tools. (To be continued.)

**24-415. Strain and Deformation Recording System.** *Iron Age*, v. 160, Dec. 4, 1947, p. 74.

Direct recording of the deformation occurring in specimens subjected to tension, compression, or flexure by means of universal testing machines, through use of a strain recording system in which two miniature variable transformers are the essential actuating devices.

**24-416. Specifying for Economy in Springs. Part II.** Ronald F. Pond. *Machine Design*, v. 19, Dec. 1947, p. 115-120.

Compression, extension, torsion, and other types of springs. Typical design problems illustrate recommended techniques.

**24-417. New High-Speed Helical and Herringbone Gear Standard.** *Machine Design*, v. 19, Dec. 1947, p. 157-158.

Although issued for use primarily in the design of self-contained speed-reducer units, the new American Gear Manufacturers Assoc. standard is said to be equally useful in the design of other types of high-speed helical gear drives.

**24-418. Designing of "Trouble-Free" Dies. Part LXXVI. Modern Trends in Die Engineering.** C. W. Hinman. *Modern Industrial "Press"*, v. 9, Dec. 1947, p. 22, 42.

**24-419. Economies Result When Parts Are Designed for Beryllium Copper.** Robert W. Carson and Wayne Martin. *Materials & Methods*, v. 26, Dec. 1947, p. 79-84.

Proper design procedures for miscellaneous applications.

**24-420. Buckling of Transverse Stiffened Plates Under Shear.** Tsun Kuei Wang. *Journal of Applied Mechanics*, v. 14 (*Transactions A.S.M.E.*, v. 69), Dec. 1947, p. A269-A274.

An analysis of buckling of simply supported rectangular plates reinforced by any number of transverse stiffeners and subjected to shearing forces uniformly distributed along the edges. 14 ref. (Presented at Annual Meeting of A.S.M.E., Atlantic City.)

**24-421. Stresses in a Notched Strip Under Tension.** Chih-Bin Ling. *Journal of Applied Mechanics*, v. 14 (*Transactions A.S.M.E.*, v. 69), Dec. 1947, p. A275-A280.

A theoretical solution, the strip being notched by a pair of symmetrical semicircular arcs on its boundaries.

*(Turn to page 50)*

## Mechanized Foundry Methods Save Labor

Reported by Knox A. Powell
*Research Engineer*
*Minneapolis-Moline Power Implement Co.*

Casting methods in automotive manufacture were illustrated with slides of Ford automotive and war work practice when Gosta Vennerholm, head of the metallurgical division of the research department of the Ford Motor Co., addressed the Northwest Chapter at a joint meeting with the Twin City Chapter of the American Foundrymen's Association on Nov. 20.

The most pressing problem in the foundry (as in all industry today), said Mr. Vennerholm, is the shortage and high cost of labor. Mechanized methods to save labor and improve working conditions have been among the major foundry developments at the Rouge plant.

Four problems that stand out in recent foundry developments at Ford, said Mr. Vennerholm, are *(a)* moisture control of the cupola blast for greater uniformity of product, *(b)* inoculation of base mixture irons to vary the metal characteristics for different uses, *(c)* accurate measurement of spout and ladle temperatures, and resin binders to replace cereal and oil binders for faster baking at lower temperatures, and *(d)* less formation of gas in the mold—all resulting in improved economy of operation.

Heat treating of cast steels to develop a full range of metallurgical properties was described by Mr. Vennerholm, including the use of continuous atmosphere-controlled time-cycle furnaces as well as local induction and flame hardening.

Mr. Vennerholm decried the faddist tendency of industry to follow the crowd and do only what others are doing, instead of striking out boldly along lines of obvious least resistance. Casting is by far the most direct method of forming and conditioning metal that has ever been devised, said Mr. Vennerholm. Ford cast crankshafts, centrifugally cast transmission and differential gears, spun cast aircraft cylinder liners, and precision cast milling cutters are examples of Ford pioneering.

## Detroit Educational Series Climaxed By Xmas Party

Reported by R. M. McBride
*Universal Products Co.*

Detroit Chapter relaxed and enjoyed a Christmas party on Dec. 8, in lieu of the regular monthly meeting. The three preceding Monday nights had been devoted to the Fall Educational Series. A steak dinner, door prizes, sociability and a floor show accounted for the entertainment of 525 members. R. C. McCleary and C. A. Hooker were cochairmen of the entertainment committee.

The first lecture of the educational series was presented on Nov. 17 by D. M. McCutcheon of the Ford Motor Co. His subject was "Industrial X-Ray and Electron Diffraction". While showing, from a practical point of view, what diffraction methods can accomplish, he also pointed out their limitations.

On Nov. 24 R. W. Smith of the A. C. Spark Plug Division, General Motors Corp., spoke on "Spectroscopy in Industry". After a short review of the physical principles underlying spectroscopic analysis, the speaker showed the necessity for cooperation and understanding between the engineer and metallurgist in order to set up a procedure having speed, precision and the degree of accuracy necessary for proper and efficient control of an analytical production problem.

The subject of the Dec. 1st meeting was "Precision Castings". Morris Bean, president of the Morris Bean Co., presented a chronological survey of the development of the precision casting art. Modern methods and current uses were also discussed.

The Education Committee was headed by E. Slaughter, Republic Steel Corp., with S. Callaway, General Motors Research Laboratories, in charge of the fall series.


# RESEARCH AND DEVELOPMENT • POSITIONS

● Senior—Intermediate—Junior level for participation in the program of investigating the application of nuclear energy to the propulsion of aircraft now being carried on at Oak Ridge, Tennessee. Salaries will be commensurate with qualifications.

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Numerical examples of the solution are compared with experimental results. 16 ref. (Presented at Annual Meeting of A.S.M.E., Atlantic City, N. J.)

**24-422. On the Use of Power Laws in Stress Analysis Beyond the Elastic Range.** Alice Winzer and W. Prager. *Journal of Applied Mechanics*, v. 14 (*Transactions A.S.M.E.*, v. 69), Dec. 1947, p. A281-A284.

In a recent paper A. A. Ilyushin drew attention to the remarkable simplicity which the theory of plastic deformation assumes when the secant shear modulus is taken as a power of the octahedral shearing stress. Ilyushin's results are discussed in connection with a specific example; great caution is necessary in the use of such power laws. (Presented at Annual Meeting of A.S.M.E., Atlantic City.)

**24-423. Note on the Tightness of Expanded Tube Joints.** G. Sachs. *Journal of Applied Mechanics*, v. 14 (*Transactions A.S.M.E.*, v. 69), Dec. 1947, p. A285-A286.

A simple theoretical evaluation of conditions conducive to maximum tightness. Residual pressure between tube and plate, which can be considered as a measure of the tightness, possesses a maximum at certain tube dimensions. (Presented at Annual Meeting of A.S.M.E., Atlantic City.)

**24-424. Torsion of a Rectangular Tube.** J. M. Klitchieff. *Journal of Applied Mechanics*, v. 14 (*Transactions A.S.M.E.*, v. 69), Dec. 1947, p. A287-A288.

A theoretical, mathematical development. (Presented at Annual Meeting of A.S.M.E., Atlantic City, N. J.)

**24-425. Deflections and Moments of a Rectangular Plate Clamped on All Edges and Under Hydrostatic Pressure.** Ezra G. Odley. *Journal of Applied Mechanics*, v. 14 (*Transactions A.S.M.E.*, v. 69), Dec. 1947, p. A289-A299.

Two solutions. The first is based on the usual procedures and the second is the method developed by H. Marcus in Germany in 1936. (Presented at Annual Meeting of A.S.M.E.)

**24-426. Approximate Solutions for Symmetrically Loaded Thick-Walled Cylinders.** C. W. MacGregor and L. F. Coffin, Jr. *Journal of Applied Mechanics*, v. 14, (*Transactions A.S.M.E.*, v. 69), Dec. 1947, p. A301-A311.

Based upon an extension of the theory of a bar on an elastic foundation, a solution is given in closed form. The analysis avoids the tedious computation of stresses inherent in exact solutions by Fourier series or Fourier-integral methods and is in a form which can easily be used by designers. (Presented at Annual Meeting of A.S.M.E., Atlantic City, N. J., Dec. 1-5.)

**24-427. A Numerical Solution for the Torsion of Hollow Sections.** E. C. Colin, Jr., and N. M. Newmark. *Journal of Applied Mechanics*, v. 14, (*Transactions A.S.M.E.*, v. 69), Dec. 1947, p. A313-A315.

Method involves use of finite differences and can be used with either the iteration procedure due to Liebmann, or the relaxation procedure attributed to Southwell. The method avoids the necessity of combining a number of separate solutions. (Presented at Annual Meeting of A.S.M.E.)

**24-428. Welded Beam Design Reduces Production Costs of Continuous Weighing Machines.** *Steel*, v. 121, Dec. 15, 1947, p. 108.

**For additional annotations indexed in other sections, see:**
**3**-407; **19**-409-426; **21**-112; **22**-743-752-766; **23**-519; **27**-255-266-267-276.

**NEW ENGLAND CARBIDE TOOL CO INC.**
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## 25 MISCELLANEOUS

**25-179. Ultrasonics in Solids.** S. Young White. *Audio Engineering*, v. 31, Oct. 1947, p. 22-24, 41-42.

Industrial applications include dental grinding; silent riveting; heating effects; casting of metals; welding; very high power generation; and use in centrifugal pumps.

**25-180. Truck for Each Job Achieves Smoother Materials Flow.** *Steel*, v. 121, Nov. 10, 1947, p. 120, 123.

Use of electric trucks in tin-plate department of Jones & Laughlin.

**25-181. Zusammenhänge der Wärme- und Energiewirtschaft mit den Erzeugungsverhältnissen von Grösseren Huttenbetrieben. (Relation Between Heat and Energy Consumption and the Producing Capacity of Large Iron Works.)** Friedrich Wesemann. *Stahl und Eisen*, v. 66-67, Jan. 30, 1947, p. 35-42.

A comparative evaluation of war and prewar statistical data results in discovery of a relationship between the heat and energy consumption and the producing capacity of different iron works.

**25-182. Three London Engineering Exhibitions.** P. Grodzinski. *Industrial Diamond Review*, v. 7, Oct. 1947, p. 289-295.

**25-183. Hanover Trade Fair, 1947.** Paul Grodzinski. *Industrial Diamond Review*, v. 7, Oct. 1947, p. 296-298.

Some of the exhibits at German fair.

**25-184. Engineering Shop Notes.** *Materials & Methods*, v. 26, Nov. 1947, p. 110.

Degreasing and soldering in one operation by use of infrared. Use of magnets for clamping of parts during miscellaneous operations.

**25-185. Trolley Conveyers.** Sidney Reibel. *Factory Management and Maintenance*, v. 105, Nov. 1947, p. 105-116.

A manual.

**25-186. In Handling These Stampings, You Can Multiply the Savings by Two.** *Flow*, v. 3, Nov. 1947, p. 22-23, 78.

Use of fork trucks for materials handling.

**25-187. Small Layout—Big Volume.** *Flow*, v. 3, Nov. 1947, p. 32-35, 60.

Materials-handling methods in assembly of refrigeration compressors.

**25-188. Is Protection of Finish One of Your Handling Problems?** *Flow*, v. 3, Nov. 1947, p. 40-46.

Method of protecting the finish on die-cast components for automobile grille assemblies.

**25-189. New Metals for Old.** Edward Appleton. *Engineering Materials and Processes*, v. 5, Oct. 1947, p. 127-130.

Condensed from Tenth Edward Williams Lecture delivered at Annual Conference of Institute of British Foundrymen.

**25-190. American Brake Shoe Co. Mechanizes Handling of Chilled Car Wheels Through Process.** *Storage Battery Power*, v. 17, Oct. 1947, p. 10-13.

Use of lift trucks.

**25-191. Physics Laboratory of the British Iron and Steel Research Assoc.** *Engineer*, v. 184, Oct. 31, 1947, p. 410-411.

**25-192. Service Watchword in Steel Jobbing.** Ralph G. Paul. *Western Machinery and Steel World*, v. 38, Nov. 1947, p. 74-77, 95-97.

How Ryerson tests the steel they obtain from the manufacturer and furnishes a detailed report to the customer.

**25-193. The Metallurgist and Atomic Energy.** Robert F. Bacher. *Metal Progress*, v. 52, Nov. 1947, p. 800-802.

The part of the metallurgist in past, present, and future developments. Applications of radioisotopes in metallurgical research. (Presented at meeting of American Society for Metals, Chicago, Oct. 23, 1947.)

**25-194. Heat Transfer to Molten Metals.** R. C. Martinelli. *Transactions of the A.S.M.E.*, v. 69, Nov. 1947, p. 947-956; discussion, p. 956-959.

A theoretical development. The relative importance of the thermal resistances of the laminar sublayer, buffer layer, and turbulent core; temperature distribution in the fluid for various magnitudes of the Prandtl modulus. The unit conductance for convective heat transfer is proportional to the square root, rather than to the first power, of the friction tractor. 20 ref.

**25-195. Oxygen for Industry.** Earl P. Stevenson. *Technology Review*, v. 50, Nov. 1947, p. 32-35, 62, 64.

New processes making possible large production, high purity, and low cost, which pave way for increased industrial utilization for oxygen.

**25-196. Cutting Costs by Cost-Cutting Tooling.** *Modern Industry*, v. 14, Nov. 15, 1947, p. 45-49.

Miscellaneous cost-saving techniques used in production of both metallic and nonmetallic products.

**25-197. Latest Developments in Metallurgy and Automatic Control Revealed at Boston Meeting of Electrochemical Society.** *Steel*, v. 121, Nov. 17, 1947, p. 98-100, 108, 110, 113.

**25-198. Continuous Casting Research Planned by British.** *Iron Age*, v. 160, Nov. 20, 1947, p. 84.

This and other metallurgical research to be investigated at the new physics department of the British Iron & Steel Research Assoc.

**25-199. Portsmouth Steel Corp. Is Well Under Way on Modernization Program.** *Steel*, v. 121, Nov. 24, 1947, p. 64-65, 122.

**25-200. Research Brains for Hire.** John R. Kinsey. *Popular Mechanics Magazine*, v. 88, Dec. 1947, p. 100-103.

A few of the many projects and successful research developments at Battelle Memorial Institute.

**25-201. The Research and Development Station of the Vereinigte Aluminium Werke Aktiengesellschaft.** *Aluminium and the Non-Ferrous Review*, v. 12, July-Sept. 1947, p. 49-52.

**25-202. Shop Handling of Magnesium.** Gilbert C. Close. *Light Metal Age*, v. 5, Nov. 1947, p. 22-23.

Methods used at Northrop Aircraft in handling, to prevent damage, and in fabrication.

**25-203. A Punch Card Filing System for Metallurgical Literature.** A. G. Guy and A. H. Geisler. *Metal Progress*, v. 52, Dec. 1947, p. 993-1000.

Convenient personal filing system. Subject index for the system.

**25-204. The Research Organization of the American Electroplaters' Society.** Richard M. Wick. *Monthly Review*, v. 34, Dec. 1947, p. 1368-1375.

**25-205. Coordinating Materials Handling With the Manufacturing Cycle.** S. C. Hoey. *Mechanical Engineering*, v. 69, Dec. 1947, p. 1007-1011.

Materials-handling problem in general; some solutions by experience obtained at Westinghouse Electric Corp.

**25-206. Materials and Power.** Clyde Williams. *Mechanical Engineering*, v. 69, Dec. 1947, p. 1012-1015.

Recent and potential developments in utilization of raw materials and in power generation, with emphasis on the part played by large-scale industrial research in all of these developments. Importance of new metallurgical developments in facilitating advances in diverse fields.

**25-207. Planned Handling.** R. O. Erickson. *Steel*, v. 121, Dec. 15, 1947, p. 95, 112.

*(Turn to page 52)*

## NATIONAL MEETINGS

**Feb. 10-11—Pressed Metal Institute.** Annual Meeting, Hotel Statler, Buffalo. (P.M.I., Union Commerce Bldg., Cleveland 14.)

**Feb. 15-19—American Institute of Mining and Metallurgical Engineers.** Annual Meeting, Hotel Pennsylvania, New York. (Ernest Kirkendall, Secretary, Metals Divisions, A.I.M.E., 29 West 39th St., New York 18, N. Y.)

**U.S. Steel Announces Improvements**

United States Steel Corp. has appropriated over 50 million dollars in 1947 for plant improvements and for expansion and modernization of its facilities in the Chicago district.

## CHAPTER MEETING CALENDAR

| CHAPTER | DATE | PLACE | SPEAKER | SUBJECT |
|---|---|---|---|---|
| Baltimore | Feb. 16 | Engineers Club | Robert B. Mears | Causes of Localized Corrosion |
| Boston | Feb. 6 | Hotel Sheraton | Francis B. Foley | |
| Buffalo | Feb. 12 | Hotel Statler | Peter Payson | The TTT-Curve as a Guide to the Heat Treatment of Steel |
| Calumet | Feb. 10 | Phil Smidt & Sons, Hammond, Ind. | Edward L. Ryerson | Why Public Relations Is an Operating Problem |
| Canton-Massillon | Feb. 4 | Mergus Restaurant, Canton | | National Officers' Night |
| Cedar Rapids | Feb. 10 | Hotel Roosevelt | C. A. Turner, Jr. | High Speed Direct Heating With Gas |
| Chicago | Feb. 9 | Furniture Mart Club Rooms | George A. Roberts | Selection and Heat Treatment of Tool and Die Steels |
| Cincinnati | Feb. 12 | Engineering Society | B. F. Shepherd | Hardenability |
| Cleveland | Feb. 2 | Cleveland Club | Francis B. Foley | Heavy Forgings |
| Columbus | Feb. 10 | Battelle Memorial Institute | Francis B. Foley | Alloys for Elevated Temperature Service |
| Dayton | Feb. 11 | Miami Hotel | W. H. Eisenman and F. B. Foley | National Officers' Night |
| Des Moines | Feb. 10 | | Ladd Salach | Plastic Patterns |
| Detroit | Feb. 9 | Engineering Society | Francis B. Foley | Alloys for Elevated Temperature Service |
| Fort Wayne | Feb. 9 | Fort Wayne Chamber of Commerce | G. E. Brumbach | Cutting Toolsteels |
| Georgia | Feb. 2 | Atlantic Steel Co., Atlanta | Harry Dearing | Steel in Agriculture |
| Indianapolis | Feb. 16 | Marott Hotel | Harold J. Babcock | Commercial Applications of Austempering and Martempering |
| Los Angeles | Feb. 26 | Southern Calif. Gas Co. | G. E. Brumbach | Quench Cracking In Toolsteels |
| Lehigh Valley | Feb. 6 | Hotel Traylor, Allentown, Pa. | B. H. DeLong | |
| Mahoning Valley | Feb. 17 | V.F.W. Rooms | Mr. Seigle | General Talk on Steel |
| Manitoba | Feb. 12 | Marlborough Hotel | | Ladies' Night Dinner Dance |
| Milwaukee | Feb. 17 | City Club of Milwaukee | C. E. Peck | Furnace Atmospheres |
| Montreal | Feb. 2 | Queen's Hotel | W. E. Thill | Sleeve Bearing Problems |
| Muncie | Feb. 17 | Muncie Central High School | W. S. Girvin | Copper and Copper Alloys |
| New Jersey | Feb. 16 | Essex House, Newark | A. G. Sturrock | Relation of Microstructure of Steel to Machinability |
| New York | Feb. 9 | Building Trades Bldg. | Maxwell Gensamer | The Alloying Elements in Steel |
| North Texas | Feb. 5 | Dallas | J. M. Hodge | Heat Treatment and Hardenability |
| North West | Feb. 19 | Covered Wagon, Minneapolis | Wm. Matthes | Precision Castings |
| Notre Dame | Feb. 3 | Engineering Auditorium, University of Notre Dame | Francis B. Foley | The Sigma Phase in Heat Resistant Alloys |
| Ontario | Feb. 6 | Royal Connaught Hotel, Hamilton | W. H. Shipman | Hot Strip Steel Production |
| Penn State | Feb. 10 | Mineral Industries Bldg. | B. M. Larsen | Problems of the Iron Blast Furnace |
| Philadelphia | Feb. 27 | Engineers Club | J. C. McDonald | Recent Developments in Magnesium Alloys |
| Pittsburgh | Feb. 12 | Mellon Institute Auditorium | Francis B. Foley | Behavior of Metals Under Stress at Elevated Temperatures |
| Pueblo | Feb. 19 | Whitman Hotel | F. L. LaQue | Corrosion |
| Rocky Mountain | Feb. 20 | Oxford Hotel, Denver | | |
| Rochester | Feb. 2 | Chamber of Commerce | Fred P. Peters | Broad Trends in Materials Use |
| Rochester | Feb. 6 | Eagles Club | | Annual Bowling Party |
| Saginaw Valley | Feb. 17 | | Mr. Burns | Die Casting |
| | | | F. D. Corfield | Heat Resisting Castings |
| | | | To Be Announced | Bearings |
| Southern Tier | Feb. 9 | Hotel Fredrick, Endicott, N.Y. | J. W. Cable | New Advances in High-Frequency Heating |
| Springfield | Feb. 16 | Hotel Sheraton, Springfield | Carl A. Zapffe | Fractography—a Study of Fractures Under High Magnification |
| St. Louis | Feb. 20 | York Hotel | E. J. Pavesic | Practical Problems In Commercial Heat Treating |
| Syracuse | Feb. 3 | Onondaga Hotel | M. C. Udy | Boron in Steel |
| Terre Haute | Feb. 9 | Indiana State Teachers College Student Union | J. W. Freeman | Theory and Practice of Metals at High Temperatures as Used in Gas Turbines, the Oil Industry, and Power Plants |
| Texas | Feb. 3 | Ben Milam Hotel, Houston | John M. Hodge | Heat Treatment and Hardenability |
| Toledo | Feb. 26 | Maumee River Yacht Club | L. W. Smith | Aircraft Metallurgy |
| Tulsa | Feb. 10 | Spartans Cafeteria | H. L. Maxwell | Metallurgical Problems and Chemistry |
| Washington | Feb. 9 | Dodge Hotel, Garden House | L. C. Hicks | Magnetic Steels |
| Wichita | Feb. 12 | Broadview Hotel | A. S. Jameson | Metallurgy of Ball and Roller Bearing Manufacture |
| Worcester | Feb. 11 | Hotel Sheraton | H. H. Lester and J. L. Martin | Metals Research and Development in National Defense |
| York | Feb. 11 | | Fred P. Peters | Recent Developments in Materials and Methods for Precision Parts |
| York | Feb. 16 | Baltimore, Md. | | Joint Meeting with Baltimore Chapter (See Above) |

Recent revisions in the materials-handling system at Morse Chain Co., manufacturers of roller, power, and automotive chain.

**25-208. How to Mark Hard Plastics.** H. O. Bates. *American Machinist*, v. 91, Dec. 18, 1947, p. 119.

New process called oil engraving can also be used on aluminum. The metal or plastic is immersed in a thin oil during the engraving process.

**25-209. Electric Hand Trucks Increase Freight Carloads.** *Iron Age*, v. 160, Dec. 25, 1947, p. 79.

Freight carloads have been increased 24% through use of small size, electric, hand-guided trucks.

## 26 STATISTICS

**26-184. Zur Gegenwärtigen Lage und Lenkung der Deutschen Eisenindustrie. (The Present Status and Organization of the German Iron and Steel Industry.)** Karl Peter Harten and Hans Hero Vosgeran. *Stahl und Eisen*, v. 66-67, Jan. 2, 1947, p. 2-10.

**26-185. Der Gasausgleich auf Huttenwerken. (Gas Balance in Blast Furnaces.)** Kurt Rummel. *Stahl und Eisen*, v. 66-67, Jan. 2, 1947, p. 19-23.

Several ways of economizing on the gas used for blast-furnace operation.

**26-186. Die Erzeugung der Deutschen Eisenindustrie von 1938 bis 1944. (Production of the German Iron and Steel Industry From 1938 to 1944.)** Hans Schmitz. *Stahl und Eisen*, v. 66-67, Jan. 30, 1947, p. 48-56.

Statistics for the different types of iron and steel products and compares development with that in the U. S. Map showing the location of the various German works.

**26-187. Vyhlidky Soudobeho Prumyslu, Vyrabejiciho Hlinik. (Outlook of the Present Industrial Production of Aluminum.)** A. Glazunov. *Hutnické Listy*, v. 2, Sept. 1947, p. 49-51.

The present method of producing aluminum. It is impossible for aluminum to be produced in Europe from bauxite according to the present methods to compete with overseas production.

**26-188. World-Wide Wire Industry.** *Wire and Wire Products*, v. 22, Nov. 1947, p. 898-903, 917-918.

Statistical reports: "Australia", by Oscar Semler. "Czechoslovakia", by Oscar Semler. "Germany", by Hubert Hermanns and Paul Fridrumuc.

**26-189. Economics of Stainless Steel Production.** Charles Staley. *Electric Furnace Steel Conference Proceedings*, v. 4, 1947, p. 129-130; discussion, p. 130-135.

Two methods most commonly used by Middletown division of Armco.

**26-190. Brazilian Ore Resources and the Volta Redonda Plant.** Ralph Vaill. *Blast Furnace and Steel Plant*, v. 35, Nov. 1947, p. 1365-1367.

Iron-ore resources and their utilization. (To be continued.)

**26-191. Minerals—The Watchdog of American Economy.** J. A. Krug. *Metals*, v. 18, Nov. 1947, p. 7, 9, 14.

Stockpiling program should not rely on foreign sources of supply to detriment of domestic producing industry.

**26-192. Strong Stockpiling Program Essential to National Security and to Conservation.** Otto Herres. *Metals*, v. 18, Nov. 1947, p. 12-14.

Fears of premature exhaustion are believed to be unfounded if newly discovered reserves are produced and stockpiled.

**26-193. Outlook for Cupola Raw Materials; Foundry Pig Iron.** Bertram S. Stephenson. *Foundry*, v. 75, Dec. 1947, p. 78-79, 226, 228, 230, 232-233.

Future supply prospects.

**26-194. Outlook for Cupola Raw Materials; Foundry Coke.** Samuel Weiss. *Foundry*, v. 75, Dec. 1947, p. 80-81, 233-234.

Supply prospects.

**26-195. Outlook for Cupola Raw Materials; Cast Scrap.** Edwin C. Barringer. *Foundry*, v. 75, Dec. 1947, p. 82-83, 222.

Steel-scrap prospects.

**26-196. Spanish Iron Ore.** H. J. Becker. *Mining Magazine*, v. 77, Nov. 1947, p. 279-280.

A survey of the industry and of its prospects.

**26-197. Stampings Star in Postwar Manufacturing Techniques.** *Steel Processing*, v. 33, Nov. 1947, p. 685-687.

Survey by Pressed Metal Institute indicates that stamping manufacturers require from 100 to 450% more steel than they were using in 1939.

**26-198. Clad Metals Makers Raise Sights to Capture New Markets.** George F. Sullivan. *Iron Age*, v. 160, Dec. 11, 1947, p. 137-139.

Several big basic steel firms are interested.

**26-199. The Pig Iron Shortage.** *Steel*, v. 121, Dec. 15, 1947, p. 61-66.

Survey of above problem as reported by 82 different foundries. Less than 20% are getting full requirements.

**26-200. Components Makers See 1948 as Good Year.** John S. Morgan. *Steel*, v. 121, Dec. 29, 1947, p. 30-31, 110.

Production, price, and demand prospects.

**For additional annotations indexed in other sections, see:**
27-277.

## 27 NEW BOOKS

**27-252. Workshop Practice. 9th Edition.** F. Johnstone Taylor. Technical Press, Ltd., Gloucester Rd., Kingston Hill, Surrey, London, England. 18s.

A revised and enlarged edition of E. Pull's "Modern Workshop Practice". Chapters on materials have been written and much additional information is given on modern gear-cutting machines and systems of testing gears and grinding. New chapters dealing with forging and welding supersede matter of less concern to the workshop machinist.

**27-253. Petrographic Microtechnique.** A. V. Weatherhead. 102 p. Arthur Barron, Ltd., London, England. 12s. 6d.

Methods used in the preparation of thin sections of rocks and similar material for examination under the microscope. All the various techniques now extant are brought together within the compass of a single volume. Only in one or two instances are any new methods developed by the author given. However, the work is by no means a mere compilation of the well-known methods, but rather a record of the technique which the author has found practicable.

**27-254. Properties of Engineering Materials. 2nd Edition.** Glenn Murphy. 459 p. 1947. International Textbook Co., Scranton, Pa.

General plan of the text has not been altered appreciably in revision. The attempt to give the student a comprehensive and well balanced perspective of the field of engineering materials has been maintained. Data on properties of metals, plastics, and other materials have been brought up to date, and nearly 100 new problems have been added. The portion dealing with metallurgy of ferrous materials has been revised to conform to the latest concepts. Among the many new developments discussed are powder metallurgy, laminated products, cold treatment of metals, high-temperature alloys, silicones, and synthetic rubber.

**27-255. Textbook of the Materials of Engineering. 7th Edition.** Herbert F. Moore. 500 p. McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York, N. Y.

Designed for use in engineering classes, this book places primary emphasis on the strength, toughness, and stiffness of stress-carrying materials. It discusses the crystalline structure of metals and the structure of wood, concrete, and plastics. New edition covers many new materials of construction developed during the war and methods for processing them. Additional data on plastics, synthetic rubber, and testing machines and methods.

**27-256. Cold Shaping of Steel.** 126 p. 1947. Heintz Manufacturing Co., Philadelphia 20, Pa.

"Cold shaping" refers to the application of different processes used in Germany, for the heavy plastic deformation of low-carbon steels. The processes include extruding, drawing, coining, and cold forging, all aided by the use of phosphate and other chemical coatings. This report consists mainly of data obtained by a military investigating team, and also a number of free translations of German documents relative to the process.

**27-257. Nickel Alloys in Railroad Equipment.** 32 p. International Nickel Co., Inc., 67 Wall Street, New York 5, N. Y.

Numerous applications of the above. Recommendations for choice of alloys for specific parts; test data.

**27-258. Illustrated Jig-Tooling Dictionary.** T. G. Thompson and R. A. Peterson. 349 p. Macmillan Co., 60 Fifth Ave., New York 11, N. Y. $7.50.

Contains over 1000 tooling terms, each illustrated by functional drawings. Besides tooling terms and procedures, such allied subjects as mathematical procedures and formulas, properties and treatment of metals, standards and basic dimensions of plastic-forming processes, are included.

**27-259. Hot Dip Galvanizing Practice. Second Edition.** W. H. Spowers, Jr. 200 p. Penton Publishing Co., 1213 W. Third St., Cleveland 13, Ohio. $6.00.

Theory of zinc coating and how to reduce dross losses to a minimum. Modern galvanizing kettles, including the tube-type heated units. Methods of galvanizing various commodities are explained. Other subjects covered include pyrometry in hot galvanizing, control of oxidation, chemical reactions of fluxes, and preparation of flux washes. Thirty-five-page bibliography.

**27-260. Symposium on Metallurgy of Steel Welding.** 104 p. British Welding Research Association, 29 Park Crescent, London, W.1., England. 10s.

Proceedings consist of the following papers, and accompanying discussion: Constitution of weld metals, by W. Andrews. A preliminary investigation of the constitution of mild-steel arc weld deposits, by H. A. Sloman, T. E. Rooney, and T. H. Schofield. An analytical examination of weld deposits from commercial mild-steel electrodes to specification B.S.S. 639A and the manufacture of artificial weld metal, by G. L. Hopkin. Comments on the role of hydrogen in relation to the cracking of alloy steel on welding, by G. L. Hopkin. The relation between the hydrogen content of weld metal and its oxygen content, by L. Reeve. Influence of sulphur and phosphorus

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## Salvage of War Planes Supplies German Industry

Reported by Joseph A. Graber
*Assistant Supervisor of Methods*
*Revere Copper & Brass, Inc.*

The condition of Germany's light metal industry before and after World War II was described in a most interesting and instructive discourse by G. D. Welty of the Aluminum Co. of America. Mr. Welty addressed the Baltimore Chapter's November meeting. Many ingenious fabricating and metallurgical practices were developed as a result of wartime shortages and the necessity of developing substitutes.

One of the greatest difficulties in the present and future industrial rehabilitation in Germany, Mr. Welty explained, lies in obtaining power and raw materials for metal production as well as in coming to some agreement as to conditions under which the industry would operate. Practically the only source of present supply lies in the salvage of wrecked war planes. These are dismantled, the various parts segregated insofar as possible, and melted down, oftentimes in specially built equipment. Refining processes are employed to reduce the magnesium content where necessary in order to produce usable compositions.

After the technical session, Mr. Welty presented a number of colored slides showing the vast damage done to the large German industrial cities.


**FOR SALE**

● t—Rockwell Hardness Tester. Type 2-A complete with Brale and support. Write Box 1-t, Metals Review.


## High-Alloy Steels Applied To Many New Developments

Reported by Richard T. Saeger
*Foreman, Metallurgical Div.*
*Bethlehem Steel Co.*

Speaking on "High Alloy Steel Development" before the Lehigh Valley Chapter, Russell Franks of the Electro Metallurgical Co. stressed the application of high-alloy steels to many new developments in industry today. Particularly interesting was his explanation of present-day uses in high temperature developments, including new designs in gas turbines.

At this meeting the sponsors of the Lehigh Valley Chapter were honored, and representatives from each of the 15 sponsors were introduced to those present.

# EMPLOYMENT SERVICE BUREAU

**The Employment Service Bureau is operated as a service to members of the American Society for Metals and no charge is made for advertising insertions. The "Positions Wanted" column, however, is restricted to members in good standing of the A.S.M. Ads are limited to 50 words and only one insertion of any one ad will be printed. Address answers care of A.S.M., 7301 Euclid Ave., Cleveland 3, Ohio unless otherwise stated.**

### POSITIONS OPEN

#### East

PROCESS ENGINEERS: With met. and chem. background for quality control work. Degree required. Write Employment Office, Chance Vought Aircraft, Division of United Aircraft Corp., Stratford, Conn.

INVESTMENT CASTING EXPERT: For Ordnance Dept. position. Responsible for making study to determine whether or not investment casting can be used in making of small arms components, supervise pilot plant operations, oversee work of assistants, coordinate and follow up precision investment casting research and development contracts entered into with outside agencies. Box 1-5.

DESIGN ENGINEER: Thoroughly familiar with design of automatic work-handling devices and conveyers. Excellent opportunity for permanent position with progressive company. Insurance and pension plan. Write Ajax Electric Co., Inc., Frankford & Delaware Ave., Philadelphia 23, Pa.

EXECUTIVE-TYPE PHYSICAL METALLURGIST: Fast-growing, well-established, medium-sized chemical concern in Philadelphia area offers opportunity as administrative head of project in expanding research organization to outstanding physical metallurgist with exp. in vacuum melting and casting of metals. Exp. or knowledge of less familiar metals of value. Salary commensurate with ability. In answering include education, exp., salary expected and photo. Box 1-10.

METALLOGRAPHER: Fast-growing chemica concern in Philadelphia area offers opportunity as head of metallographic lab. to metallographer with previous technical exp. Background of interpretation unnecessary. In answering give education, exp., salary expected and photo. Box 1-15.

#### Midwest

POWDER METALLURGIST: Exp. For work on both fundamental and applied research problems. Should be able to initiate and carry out over-all research program. Salary and position commensurate with background and exp. Metals Research Dept., Armour Research Foundation, Chicago 16, Ill.

NONFERROUS METALLURGIST: Excellent opportunity for grad. metallurgist exp. in general nonferrous problems. Should be able to initiate and carry out over-all research program. Salary and position commensurate with background and exp. Metals Research Dept., Armour Research Foundation, Chicago 16, Ill.

FOUNDRY RESEARCH METALLURGIST: Ferrous fdry. background. Work on both fundamental and applied research problems. Should be able to initiate and carry out over-all research program. Salary and position commensurate with background and exp. Metals Research Dept., Armour Research Foundation, Chicago 16, Ill.

GRADUATE ENGINEER: To conduct research and development work in electronics in metal fabricating plant. May also serve as welding technician. Understanding of met. and mechanics desirable. Box 1-20.

### POSITIONS WANTED

HEAT TREAT SUPERVISOR OR HEAT TREATER: Age 53, widower, 23 yr. exp. Familiar with all modern heat treating practices including induction heat treating and nitriding. Thoroughly competent to select and supervise treatment cycles on carbon, alloy, stainless and high speed steels. Exp. with operation and maintenance of modern heating and control equipment. Formally educated in met. and metallography. Box 1-25.

STAINLESS STEEL METALLURGIST: Age 36, married, grad. metallurgist, 9 yr. exp. with manufacture and fabrication of stainless bar, wire and sheet, 3 yr. exp. with plain carbon and alloy steels and 2 yr. with brass alloys. Has worked with all phases of plant processing as well as laboratory research and development. Qualified for position as chief metallurgist or director of research. Box 1-30.

GOVERNMENT CONTACT MAN: Material engr. now employed by U.S. Government in Washington, D.C., desires connection with established firm mfg. or fabricating metals and alloys as rep. for Government contact and service. Knows key personnel in all depts. and is familiar with Government methods. Married, age 47, available on short notice. Box 1-35.

METALLURGIST: With structural eng. qualifications. College training. 5 yr. exp. in all phases of production and research with the greatest Canadian railroad firm. 1 yr. exp. in structural drafting and design with boiler mfg. Desires position as plant metallurgist or position offering research and development. Free to travel anywhere. Box 1-40.

METALLURGIST—FURNACE ENGINEER: B.S. Met. Eng., age 31, 4 yr. general heat treat exp. in large automobile mfg. plant; also research work and publications concerning gas carburizing and controlled atmospheres. 2 yr. exp. with mfg. of large industrial furnaces; activities included design, estimating, sales, development and metallurgical consulting. Box 1-45.

METALLURGIST: M.S. in met., M.I.T. Exp. in physical and mechanical met. Now employed in research on precision casting. Available for position where initiative and enterprise are needed as well as technical ability. Imaginative but practical. Some sales exp. Location unimportant if living conditions are satisfactory. $4500 min. salary. Box 1-50.

METALLURGICAL ENGINEER: 1941 grad. Employed in alloy steel plant. Extensive exp. in forge shop, melting, rolling, testing, application, general quality control. Desires position along above lines or met. eng. in small plant. Box 1-55.

METALLURGICAL ENGINEER: College degree in met. Varied exp. in the ferrous and nonferrous metal industries as metallurgist. Knowledge of high-alloy steel making and heat treatment, melting, casting, extrusion and drawing of magnesium and aluminum. Box 1-60.

METALLURGIST AND PERMANENT MOLD DESIGNER: Age 28, single. Exp. in aluminum and bronze permanent molding design and operation. Can take complete charge of permanent mold dept. Exp. includes all fdry. operations. Any location. Box 1-65.

METALLURGICAL ENGINEER: Age 25, married, veteran. Graduating with B.S. in met. eng., University of Illinois, Feb. 1948. 9 mo. exp. in metallurgical research as lab. assistant. Desires position with future in development or production. Available Feb. 15, 1948. Box 1-70.

REGISTERED PATENT ATTORNEY: Seeks part-time position with New England industry. Member of state and federal bars. Exp. in all phases of patents comprising fields of met., chem., mechanics, electrochemistry and electronics. Box 1-75.

GRADUATE METALLURGICAL ENGINEER: With 2 yr. exp. checking specifications and designs for eng. materials. Desires position as junior met. eng. or metallurgist. Prefers work in metallography or materials' testing lab. Will undergo training period, if necessary, for length of time and salary which employer deems appropriate. Box 1-80.

TECHNICAL FOUNDRY EXECUTIVE: Desires position with progressive mfr. in the Chicago area having fdry. as part of operations. Grad. met. eng. 11 yr. fdry. operating and technical exp. Broad background in industrial relations, cost control and industrial eng. Box 1-85.

MANUFACTURER'S AGENT: Metallurgist with wide exp. in mfr., technical service and sales of ferrous and nonferrous metals and chemicals is now ready to add several new lines. Qualified to help mfr. with market research, preparation of technical and sales promotion literature. Can furnish capital to companies for expansion. Will consider representation in Pa., N.J., Del., Md. and District of Columbia. Excellent business, social and technical society contacts. Box 1-90.

METALLURGICAL ENGINEER: Age 26. Desires position with opportunity for advancement. 1 yr. exp. as process metallurgist in automotive plant. 1½ yr. exp. as fdry. metallurgist and melt supervisor in nonferrous smelter and refiner. Desires position in sales or production. Prefers Michigan area. Box 1-95.

METALLURGIST: Age 31, married, 2 children. 5 yr. exp. in supervision and control of large gear heat treatment, thoroughly familiar with controlled atmospheres including continuous and pit-type gas carburizing. Knows microscopic examination and physical testing. Desires responsible position with progressive organization offering stability and individual opportunity. Box 1-100.

RESEARCH METALLURGIST: Age 25, B.S. in met., 1943. 2 yr. exp. in corrosion research of light metal alloys. 1 yr. exp. in metallography and production met. Naval deck officer for 2 yr. 2 yr. previous exp. as chemist. Box 1-105.

HEAT TREAT FOREMAN: 8 yr. exp. in large steel mill in the east. 4½ yr. exp. in tool and die hardening. West Coast preferred—Los Angeles or San Francisco area. Box 1-110.

on weldability of mild steel, by L. Reeve. Statement on work of F.M.3 Committee on constitution of weld metal, by G. L. Hopkin. Effect of initial heating temperature on the mechanical properties of an air hardened Ni-Cr-Mo steel, by J. A. Wheeler and V. Kondie. An apparatus for the determination of the viscosity of welding slags, by P. K. Gledhill. Electrophysics of the welding arc, by L. H. Orton. Cracking of welded gas mains, by L. Reeve. A roundtable discussion of weldability testing.

**27-261. The Sampling and Assay of the Precious Metals. Second Edition.** Ernest A. Smith. 505 p. Charles Griffin & Co., Ltd., London, W.C.2, England. 42s.

This book is not greatly different from the 1913 edition with the exception of two chapters dealing with the platinum metals which appear to include all the latest information. Emphasizes practical considerations, including necessity for proper sampling.

**27-262. Chemical and Technical Stenography.** James Kanegis. 388 p. Edwards Brothers, Inc., Ann Arbor, Mich. $5.00.

A text of 435 units for reference, self-study or teaching assignments. Designed to help the technical secretary using the Gregg system.

**27-263. Résumé of High Temperature Investigations Conducted During 1946-1947. V. 3.** 112 p. Timken Roller Bearing Co., Steel and Tube Division, Canton, Ohio. Copies will be sent free to those who can use them to advantage.

The sixth publication of a series running back to 1940. The entire group of publications constitutes a voluminous record of work on C-Mo, Cr-Mo and high Cr-Ni steels unusual in scope. Unique, also, is the fact that the Timken organization, which has sponsored a continuous program of high temperature research at University of Michigan since 1928, is willing to share its results so generously with industry—competitors and customers alike.

**27-264. Spectrochemical Abstracts.** Ernest H. S. van Someren. Adam Hilger, Ltd., 98 Pancras Way, London, N.W.1, England. $3.50.

Continues work instituted by this leading British optical firm. The 407 citations for 1940-1945 almost exactly equal the number in the two previous volumes (1933-37 and 1938-39). While many of the articles appearing in literature apply to physical and other sciences, the largest subdivision applies to "metals and alloys" (164 abstracts). The abstracts appear to be unusually informative nuggets; for this the abstractor is to be congratulated.

**27-265. Forming of Austenitic Chromium-Nickel Stainless Steels.** Vsevolod N. Krivobok and George Sachs. 320 p. The International Nickel Co., Inc., 67 Wall St., New York 5, N. Y. Limited distribution.

Data from American companies are assembled in this comprehensive book. Representative parts, from the simplest dish to the most complex engine manifold, pressed or molded from stainless steel sheet, are described in detail. In nearly every instance a series of drawings shows the blank, the blanking layout, the preformed part and tools, trimming and holddown allowances, and the finished form and tools (often in perspective). Operations discussed in such detail include not only the conventional pressing, stamping, bending, cupping, and tube flanging, but the action of rubber platens, the "Guerin process", so widespread during the war. Less usual methods of roll forming, draw bench work, and the very difficult flanging of lightening holes in contoured shapes, are illustrated in exhaustive detail. Refreshing is the admission that stainless steel sheet can split, score and otherwise act disconcertingly; methods of avoiding such troubles are given. This book is unique, and will be invaluable to all workers in sheet metal. It is also a magnificent job of illustration and bookmaking. E.E.T.

**27-266. Machine Design.** Louis J. Bradford and Paul B. Eaton. Fifth Edition. 283 p. John Wiley & Sons, Inc., 440 Fourth Ave., New York, N. Y. $3.25.

Intended as a textbook. Topics include fundamental definitions, friction and lubrication, bearings and sliding surfaces, friction clutches and brakes, shafts, force and shrink fits, screws, gearing, belts and chains, springs, flywheels, and miscellaneous machine elements.

**27-267. Industries Answeright.** Charles Z. Smith, Sr. 440 p. Genaflash Co., 105 Grove Ave., Albany, N. Y. $6.00.

Intended for both the experienced mechanic and the student just out of school, this volume includes hundreds of fully illustrated practical problems. Outlines for determining dimensions of standard and special-thread gages. Dimensions for several thousand plug and ring gages. Detail drawings of thread plug gages, thread ring gages, and interlocking and staggered-tooth cutters. A unique slide-rule digit system is explained in detail. Eight-place tables of the natural trigonometric functions and other useful tables.

**27-268. Materials Handbook. Sixth Edition.** George S. Brady. McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York, N. Y. $7.00.

General information, with the most commonly used comparative figures, is given on materials in their group classifications. Patented and trade-named materials are described. Some processed industrial materials have been included for more intelligent judgment of the basic raw materials and because these materials are the raw materials for some industries.

**27-269. An Introduction to Crystallography.** F. C. Phillips. 302 p. Longmans, Green and Co., 55 Fifth Ave., New York 3, N. Y.

An introductory text for students and also for those physicists and chemists entering upon this field. Crystal morphology and graphical and numerical procedures used in its study. The 32 crystal classes, parallel growth, and twinning. The study of mathematical relationships assumes only a minimum of mathematical knowledge. Space groups; relationships of crystal habit to the symmetry of the structural pattern.

**27-270. Molybdenum in Steel.** Climax Molybdenum Co., 500 Fifth Ave., New York, N. Y.

The effects of molybdenum in steel, the mechanical properties of molybdenum steels and applications where these steels may be usefully employed.

**27-271. A.S.T.M. Standards on Copper and Copper Alloys.** 480 p. American Society for Testing Materials, 1916 Race St., Philadelphia, Pa. $4.00.

1947 A.S.T.M. standards of 12 widely used standards covering various nonferrous metals, such as slab zinc, silicon copper, nickel, lead, and others. Methods of tests.

**27-272. Shot-Peening. Third Edition.** 181 p. American Wheelabrator & Equipment Corp., Mishawaka, Ind. $1.50. Free to executives upon request.

All of the information included in the previous edition plus comprehensive papers on the subject by J. O. Almen of General Motors Research Laboratories and O. J. Horger of Timken Roller Bearing Co. Mr. Horger's article reviews the history of shot-peening and includes a thorough study of all literature on the subject as well as much original work by the author. Mr. Almen's paper discusses the use of shot-peening for improving the fatigue strength of machine parts and also the theory of fatigue failures. H. F. Moore of the University of Illinois discusses in considerable detail the theory of fatigue and how it is affected by shot-peening.

**27-273. Methods of Measuring Temperature. Third Edition.** Ezer Griffiths. Charles Griffin and Co., Ltd., 42 Drury Lane, London, W.C.2, England.

Adds relatively little to the previous edition, published in 1925. The relevant literature of the past 20 years has been scrutinized and the present text is considered to be a reliable modern survey of a field in which Dr. Griffiths is an acknowledged authority. Emphasis is on precise thermometry rather than on the appliances and approximate methods of industry, although the latter are not wholly neglected.

**27-274. Industrial Application of Infrared.** James Doyle Hall. 201 p. McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York, N. Y.

Written from a practical point of view, this manual for the executive, supervisor, plant engineer tells how to use infrared radiation to achieve better and more economical surface finishes and how to apply it to other industrial heating jobs. Available equipment, its operating characteristics, and essential design and installation data. Use of infrared heat in such fields as metalworking, wood finishing, textiles, paints, paper, plastics, ceramics, and many others.

**27-275. Manual of Aluminum Casting Alloys.** 78 p. Aluminum Research Institute, Chicago, Ill.

The results of an extensive experimental investigation of the engineering properties of the aluminum casting alloys, conducted at Case Institute of Technology over a period of several years. Tables of data resulting from statistical analysis of a large number of test results; and photographs showing test procedures, specimens used, and typical microstructures, also concise descriptive material. Several technical papers resulting from the investigation are listed, only one of which has been published to date.

**27-276. Light Metals in Structural Engineering.** L. Dudley. 216 p. English Universities Press, Ltd., St. Paul's House, Warwick Square, London, E.C.4, England. 30s.

Strength of materials and characteristics of the light metals. Elastic constants, resilience, torsion, bending of beams, deflection and resilience of beams, design of beams and girders, cylindrical tubes or pipes, joints and keys, columns, combined loads and live loads, nature and properties of light metals, and miscellaneous structural materials.

**27-277. Annual Statistical Report; American Iron and Steel Institute, 1946.** 162 p. 1947. American Iron and Steel Institute, 350 Fifth Ave., New York, N. Y.

**27-278. Aircraft Sheet Metal.** Rollen H. Drake. 233 p. Macmillan Co., 60 Fifth Ave., New York 11, N. Y.

Important phases of aircraft sheet-metal work. Volume is suitable either as a class text in vocational courses, aviation ground schools, and trade schools, or as a mechanic's handbook. Identification and uses of the metals and alloys commonly used in aircraft fabrication, the theory underlying the fabrication of sheet metal, and the treatment before and after fabrication. Methods of forming and fastening sheet metal.

**27-279. Survey of the British Scientific Instrument Industry.** 48 p. The Times, 26 Russell Square, London, W.C.2, England.

Thirty-four articles covering the various fields.

**27-280. The Chemistry and Metallurgy of Dental Materials.** J. Campbell Smith. 317 p. Blackwell Scientific Ltd. Publications, 49 Broad St., Oxford, England. 21s.

The science of dental materials, their composition, properties, uses, and processing technique. Treatment is divided into three sections: dental metals and alloys; inorganic materials other than metals; and organic materials. A short discussion of organic chemistry in its relation to dentistry is appended.

**27-281. Electric Furnace Steel Conference, Proceedings.** V. 4. 282 p. American Institute of Mining and Metallurgical Engineers, 29 W. 39th St., New York 18, N. Y.

Papers presented at Pittsburgh Meeting, Dec. 5-7, 1946, as well as accompanying discussion. Topics included are: metallurgy; charging practice; oxidizing-slag heats; stainless-steel production; high-speed-steel production; high-alloy-steel production; importance of slag in acid practice; and sulphur and its elimination. (Individual papers previously annotated.)

Over 8000 digests covering published developments during 1947 will appear in Vol. 4, ASM Review of Metal Literature. Vols. 1, 2 and 3 together give you three-year index to the metal industry. Each Vol. $10.00 to ASM Members. $15.00 to Nonmembers. American Society for Metals, 7301 Euclid Ave., Cleveland 3.


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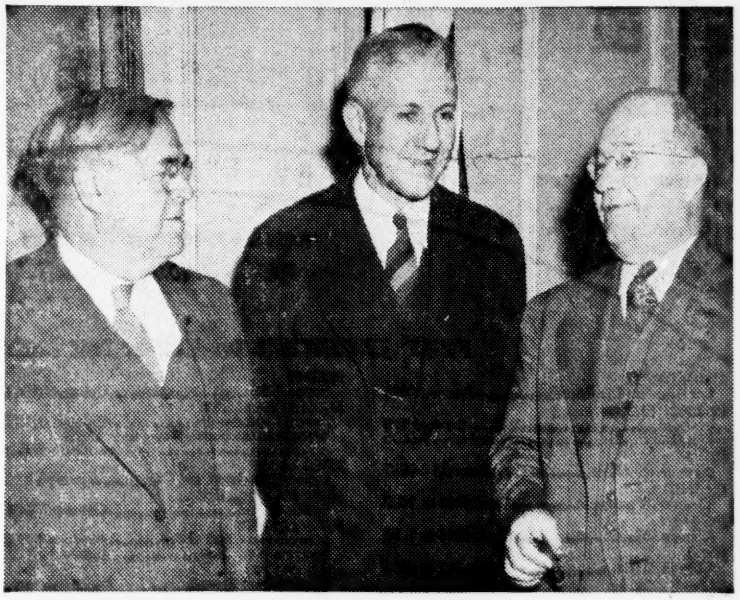

*"Physical Testing, Up to Date and Simplified" Was Expounded Before the Boston Chapter on Dec. 5 by Francis G. Tatnall of Baldwin Locomotive Works (Center). Left is Prof. I. H. Coudrey of Massachusetts Institute of Technology, technical chairman of the meeting; and right is Horace Ross of Henry Disston & Sons, Inc., acting chapter chairman in the absence of Messrs. Lutts and Geerts*

# Brass Applications Grouped by Industry

Reported by W. R. Holden
*Canadair Limited*

Of some 3000 different copper alloys produced, about 40 of them are consumed in quantity in the United States, Malcolm A. Buell of Bridgeport Brass Co. told the Montreal Chapter on Dec. 1. Of these, free-turning brass rod represents the largest volume, followed closely by the 65% copper, 35% zinc alloy and the 70% copper, 30% zinc alloy; third is probably the 85% copper, 15% zinc mixture.

Mr. Buell's subject was "Applications of Brass". These he grouped by industry or use as follows: automotive, electrical, plumbing, ammunition, jewelry, household, transportation, fasteners, hardware, architectural, and industrial power. Reasons for selection of copper and copper alloys Mr. Buell listed as *(a)* ease of cold working, *(b)* machinability, *(c)* good corrosion resistance, and *(d)* pleasing colors and ease in finishing by polishing or plating processes.

After describing certain specific applications, Mr. Buell turned to common addition elements in the copper-zinc alloys. Principal among these is lead, added for free machining and hot forging or pressing. By far the greatest use for tin is in admiralty metal for condenser tubes. Small amounts of arsenic (up to 0.25%) are also added to the alloy or to aluminum brass or muntz metal tubes to increase their resistance to dezincification.

Nickel is added to form the alloys known as nickel-silver (used as a base for silver plate, for jewelry and for fasteners) and as cupronickel (used primarily for tubes in marine service).

The phosphor bronzes containing 5, 8 and 10% tin have increased wear resistance, spring properties and fatigue strength. The silicon bronzes, developed about 20 years ago, have properties similar to the phosphor bronzes but are more economical to produce.

Another alloy of prominence is made by adding aluminum. High strength, hardness, resistance to wear and corrosion are attributes of the aluminum bronzes. Iron may be added to increase the strength, and nickel to make the alloy heat treatable; silicon is added for machinability. These alloys are used for bushings, valve stems, and in the chemical industry.

## Die Casting Company Formed

The Lukens Aluminum Co. is a newly formed organization in Dayton, Ohio, for the die casting of aluminum alloys. This firm is headed by W. B. Kindrick as general manager, Charles Briggs as factory manager and James L. Erickson as director of sales and engineering.

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